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OVERCOMING THE ILLUSION OF SECURITY:

CREATING A NEW SPACEFARING SECURITY STRATEGY PARADIGM

by

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America's economic viability and military strength depend on the security of its space systems. However, current U.S. space strategy fails to ensure free access to, and use of, space. The increasingly congested, contested, and competitive space environment require a change in the U.S. strategic approach to secure spacefaring. This paper outlines an approach for a new National Strategy for Spacefaring Security and provides a conceptual framework to help ensure the U.S. maintains the secure, unencumbered, and sustainable use of space.

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This paper is entirely my own work except as documented in footnotes.

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ABSTRACT

America's economic viability and military strength depend on the security of its space systems. However, current U.S. space strategy fails to ensure free access to, and use of, space. The increasingly congested, contested, and competitive space environment require a change in the U.S. strategic approach to secure spacefaring. The new National Strategy for Spacefaring Security provides the conceptual framework to ensure the U.S. has the secure, unencumbered, and sustainable use of space. The strategy outlines an approach to establish spacefaring security, spacefaring protection, and global engagement capabilities. It provides a focused, cohesive strategy to allow the U.S. to focus limited resources while simultaneously addressing a wide range of challenges.

The nested approach blends U.S. government and commercial security activities and works towards establishing the necessary capabilities, international policies, and organizations to improve spacefaring security for all nations. Each layer of the strategic model requires unique but interdependent resources to achieve the objectives. The layers of the model represent the strategic ways and the resources represent the means. Using the ends, ways, and means strategy model helps identify capabilities and structural gaps thereby outlining major risk areas.

The goal of the National Strategy for Spacefaring Security is to build national strength while creating an international regime to deal with today's space environment and associated security concerns.

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CHAPTER 1: INTRODUCTION

The United States' economic security and military strength depend on the security of its space systems, thus the U.S. has a vital national interest in the defending its space capabilities. However, the current U.S. space strategy does not outline an approach for defending U.S. space assets. Rather, the strategy primarily relies on international cooperation and space system resilience to deter aggression and to protect free access to, and use of, space. Although the strategy states America will take action, if necessary, to defeat attacks against its space capabilities, it does little to support that claim. This strategy failure is concerning given the increased threats from a congested and contested environment. Even more alarming is the lack of a cohesive approach for defending American space systems from attack given the U.S. reliance on space capabilities. These failures indicate major shortfalls in the current U.S. National Security Space Strategy (NSSS). The U.S. must correct this strategic disconnect because vital U.S. national interests are at stake.

As threats continue to increase in the domain, an attack against U.S. space systems will eventually require the U.S. to react and defend its national interests. America cannot continue to rely on flawed strategy to shape an effective response. Therefore, the U.S. must change its paradigm and build a new strategy to address the problems of a congested, contested, and competitive space environment. The strategy must address spacefaring defense rather than attempting to secure the entire domain.

Thus, the purpose of this research is to establish a new National Strategy for Spacefaring Security that goes beyond cooperation and resilience and establishes a cohesive approach to defend U.S. interests in space and defeat attacks on U.S. systems.

The strategy requires establishing spacefaring security, protection, and global engagement capabilities in order to defend U.S. systems and protect U.S. vital interests.

Establishing a new U.S. strategy is necessary for the long-term security of spacefaring and protection of U.S. economic and military prowess. Arguably, the connection between space capabilities and economic and military strength is not inherently obvious. In fact, space capabilities permeate every aspect of modern society. Space systems enable everything from television to automatic teller machine (ATM) transactions. They contribute to nearly all navigation and weather forecasts; provide satellite radio and pay at the pump gas services; civilian uses for space based imagery and reconnaissance products are abundant; and even farmers are beginning to use weather satellites to help increase crop yields. Nearly every business utilizes space capabilities and nearly every U.S. citizen relies on space every day to maintain their way of life.

For national security, space capabilities provide global situational awareness, treaty monitoring capabilities, and instantaneous world-wide communications. Military operators and leaders rely on space systems for intelligence, communications, navigation, warning and precision engagements. Space capabilities are woven into the fabric of military operations; the loss of space capabilities would likely set the U.S. military back to technologies similar to those used in the 1960s.

To protect these capabilities, the U.S. must treat space security, like homeland, maritime, and aviation security, as a vital national interest. Security strategy objectives for space operations should interrelate to the other domain security strategies to weave a cohesive approach to national security. Like the other domains, a security strategy for space activities should focus on securing what is important in the space domain. Thus,

the new strategy must focus on spacefaring rather than the entirety of space. While the strategy for spacefaring security is inherently different from other national security strategies, the U.S. must address the threats with a similar holistic approach and the strategy must clearly address defense regardless of political sensitivity.

Chapter 2 examines how the evolution of space security led to the existing space security posture and discusses the challenges to spacefaring given the current security environment. It then analyzes today's NSSS against those environments. Chapter 3 then addresses the shortfalls in the existing NSSS. The context of this chapter is to shape a spacefaring strategy. It identifies the desired end state and new strategic objectives for a National Strategy for Spacefaring Security. Finally, it builds a strategic model for spacefaring security that addresses the ends, ways, and means and establishes a cohesive structure to focus security, protection and global engagement efforts. Chapter 4 identifies recommendations for improving spacefaring security. This chapter reconsiders the challenges to spacefaring in the current environment and addresses how to advance spacefaring into the future.

The focus of this research is on space security. It does not discuss space exploration activities or economic growth beyond that related to security efforts. Additionally, this paper purposefully does not discuss specific capabilities due to classification concerns. Rather, this research focuses on strategic issues needed to resolve spacefaring security challenges and focus U.S. efforts to secure vital U.S. space capabilities.

CHAPTER 2: SCOPING THE STRATEGIC PROBLEM

> *"We, the United States of America, can be first. If we do not expand the thought, the effort, and the money required, then another and more progressive nation will. It will dominate space, and it will dominate the world."*[1]
>
> – James H. Doolittle (1959)

It is important to understand history to begin the process of redesigning spacefaring security. In 1957, the Soviet Union launched Sputnik and ushered in the space age. With it came intense competition between the world's two major powers. Thus, Cold War fears and bilateral competition shaped the original U.S. space strategy.

Most historians recognize the Cold War competitiveness that defined the space race. Americans believed the race would result in a winner and a loser; the winner would gain national prestige and the loser would risk extinction of their way of life. The initial competition revolved heavily around the U.S. and U.S.S.R. but, with time it expanded to other nations who wanted to prove their might and gain advantages from space.

The race to the moon is a prime example of the intense competitiveness between the U.S. and the U.S.S.R. President Kennedy challenged the US to place a man on the moon, to prove American might and demonstrate U.S. superiority in space. Kennedy recognized he would have to place U.S. economic efforts on a wartime footing to beat the Soviets and he carefully selected the moon race as the most probable to result in a U.S. victory.[2] Thus, the competition drove U.S. strategy and set the stage for U.S. dominance

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[1] Everett C Dolman, *Astropolotik: Classical Geopolitics in the Space Age*. (New York: Frank Cass Publishers, 2002), p. 86.

[2] John M. Logsdon, *Human Spaceflight: Projects Mercury, Gemini, and Apollo*. Vol. 7, (Washington D.C.: Government Printing Office, 2008), p. 480. The NASA report outlines correspondence between Wernher von Braun and President Kennedy in 1961. It states the U.S. would likely not beat Russia in placing a lab in space or orbiting the moon. But he believed U.S. had a high probability of being the first to put a man on the moon if the U.S. made heavy investments in pursuing the required technology. It also highlights how the Russian opponent was on a wartime footing.

in space as the standard for future activities.

A heavy focus on technology also guided and shaped initial space strategies. The technology preceded policy and the establishment of international norms. Three years after Sputnik, the U.S.S.R. successfully placed the first man in space. One month later Alan Shepard became the first American in space. Shortly after, the U.S. and U.S.S.R. were both heavily investing in space to gain national strategic advantages by establishing space dominance and space based capabilities. The U.S. strategy centered on the need to ensure victory in the technological battle and protection from a Soviet nuclear strike. Thus, deterrence drove initial space strategy. Yet, early space policy did not focus on deterring space aggression; it centered on deterring nuclear war.

From the beginning of the space race, space was not a "sanctuary." Weapons of mass destruction could pass through the domain unhindered. Both nations invested in technologies to secure the "high ground" and tested anti-satellite (ASAT) technologies. These efforts were driven by the need to protect sovereign territory on earth. Yet, as the space race developed, so did debates over space weapons. The debate over weaponizing space exposed that pre-space age laws were insufficient to govern new space based threats. As a result, the international community rushed to establish some international guidelines for space.

The most prominent of the treaties that govern space activities is the Outer Space Treaty (OST) signed in 1967. The OST is one of five United Nations' (UN) space treaties. Article IV of the OST prohibits the deployment of weapons of mass destruction in outer space or on celestial bodies and bans military fortifications, weapons tests or

military maneuvers on the Moon or other celestial bodies.[3] Those provisions are the only major prohibitive statements in the treaty. The other Articles largely set guidelines for the exploration and peaceful use of outer space.[4]

The limited nature of the treaty is understandable given that the UN approved the OST during the height of the space race and before the U.S. landed a man on the moon. At that time, few nations, to include the U.S. and U.S.S.R., had sufficient means to fully exploit satellites and little was known about space exploration or exploitation. The UN rushed treaty approval to establish an international agreement before either superpower could gain an advantage in space. The rush meant there was little time or effort spent attempting to gain consensus on key issues related to space defense or space weaponization.[5] Since then, the treaty has had no major revisions despite significant changes in exploitation of space. Nor has the UN been able to establish a common understanding or agreement on space defense or space weaponization despite the ratification of four other space treaties.

The four other space treaties did address some issues that were beyond the scope of the OST; however, the existing UN treaties fail to address many current space issues. For example, the treaties addressed astronaut safety, liability responsibilities, minimal satellite registration requirements, and acceptable behavior on the moon and other celestial bodies.[6] However, they failed to address defense of space systems or space weaponization and they do not address any major issues associated with satellite operations or acceptable behaviors in outer space beyond those conducted on celestial

[3] United Nations. *United Nations Treaties and Principles on Outer Space*. (New York: United Nations. 2008), p. 4.
[4] Ibid, pp. 4-5.
[5] Everett C Dolman, p. 129.
[6] Ibid, pp. 129-141.

bodies. Complaints about the treaties include that they "serve little use because of their 'very general' language"[7] and that they lack enforcement and verification mechanisms.[8] These issues call into question the legal practicality and usability of existing treaties when applying them to the current space security environment.

The Space Weapons Discussion

Ultimately, the existing space regime does little to outline acceptable defense mechanisms and fails to address deterring aggression in space. This failure leaves the space weapons debate largely unaddressed in international law. Although most agree deterring aggression is better than fighting in space, there is still little agreement related to how to deter irresponsible aggression or irresponsible behavior in space. For deterrence to be effective there must be a credible capability designed to prevent or respond to threats. For the capability to credible and there must be a willingness to use it and it must be capable of either to denying an adversary the ability to attack or capable of retaliating if necessary.[9] Capability requires weapons.

It does not mean that weapons are the only tool or that the use of weapons is the first resort. Weapons should be the last resort; after all, it is in all spacefaring nations' best interests to avoid hostilities in space.[10] However, no means of diplomacy, international cooperation, or punishment can prevent an attack if the aggressor is determined to deny space capabilities. Additionally, the U.S. is possibly the most

[7] Jacob M. Harper, "Technology, Politics, and the New Space Race: The Legality and Desirability of Bush's National Space Policy under the Public and Customary International Laws of Space." *Journal of International Law*. Vol. 8, Issue 2 (Winter 2008), p. 682.

[8] Everett C Dolman, p. 139.

[9] Gregory D. Miller, *The Shadow of the Past: Reputation and Military Alliances Before the First World War*. (Ithaca N.Y.: Cornell University Press, 2012), p. 10.

[10] U.S. Department of Defense. *National Security Space Strategy, Unclassified Summary*. by Secretary of Defense Robert M. Gates and Director of National Intelligence James R. Clapper. (Washington, D.C.: Department of Defense. 2011), p.11.

vulnerable to an attack on its space systems. America is heavily reliant on space capabilities and the U.S. has an asymmetric advantage in space because of its dominance in the domain. The U.S. cannot simply hope all nations will behave responsibly or that diplomacy will prevent an attack; therefore, the U.S. must have weapon systems capable of protecting its space systems.

Of course, this is the most controversial aspect of deterrence as it relates to space. Since the beginning of the space race, most theories on space power have fallen into one of two diametrically opposed schools of thought. Those are "space as strategic *sanctuary* and space as the ultimate *high ground*."[11] The sanctuary theory contends space should be kept free from weapons and warfare and that it is actually a moral obligation to protect the last of the global commons from the perils of war.[12] It is argued that because space warfare could potentially destroy the space domain as a usable resource then all efforts must be taken to prevent weaponization of space.[13] Still others argue the sanctuary theory because it is in the nation's "best interests."[14]

On the opposite side of the debate is the belief that space is the ultimate high ground. This theory contends the nation that controls space will have unprecedented power. The argument is space "offers the side that holds it commanding overviews, fields of fire, and defensive position. In this view, space is the 'ultimate high-ground' for the terrestrial battlefield."[15] Most supporters of this theory believe that the weaponization of space is inevitable; therefore, it would be a dereliction of any national security strategy not to develop space weapons, if for no other reason than for defense. The counter to this

[11] Everett C Dolman, p. 149.
[12] Ibid. pp. 149-153.
[13] James C. Moltz, *The Politics of Space Security : Strategic Restraint and the Pursuit of National Interests.* (Stanford, California: Stanford Security Studies, 2008), pp. 20-23. Moltz discusses comparison of space to Antartica as a possible case for protecting the global commons.
[14] Ibid. pp. 27-31.
[15] Everett C Dolman, p. 152.

argument goes back to keeping space free of weapons to prevent another arms race.

In reality, the debate is moot because space weapons already exist. The debate lingers because there is no agreement on the definition of a space weapon or use of such weapons. Are ground based satellite communications (SATCOM) jammers space weapons? If not, would the jammer be a space weapon if it was space based but targeting the same satellite links? Most would at least agree an anti-satellite (ASAT) system is a space weapon. Thus, since the United States, Russia, and China have all demonstrated ASAT capabilities it is clear that the weaponization of space has already occurred. Some believe banning ASATs will stop weaponization.[16,17] However, since any operational satellite has the potential to act as an ASAT weapon, either intentionally or unintentionally, then at least 60 nations potentially have ASAT capabilities. The point is, space weaponization is already a reality. What is not inevitable, however, is what type of systems will be developed, how those systems will be used, and whether or not their development will result in another Cold War-style arms race.

The Space Security Environment

A strategy cannot fully address weapons requirements without understanding the strategic environment and the potential threats created by an increasingly congested, contested, and competitive space domain. Discussions at the United Nations in October 2013 focused on those very themes as does the current U.S. National Security Space Strategy.[18] Indeed, the number of nations and consortia operating in space has

[16] Bruce MacDonald, *China, Space Weapons, and U.S. Security,* (Washington D.C.: Council on Foreign Relations, 2008), p. 3, 5.

[17] Bert Chapman, *Space Warfare and Defense,* (Santa Barbara, California: ABC Clio, 2008), pp. 143-145.

[18] United Nations Institute for Disarmament Research, *2013 Conference Report on Space Security.*, p. http://www.unidir.org/files/publications/pdfs/space-security-2013-en-467.pdf (accessed Nov 20, 2013), p. 1-2.

significantly risen since the initial days of the space race (see Appendix 1)[19]. Today more than 60 nations have satellites in space and the number of nations with launch capabilities continues to rise.[20][21] The increased number of satellites also means the radio frequency spectrum is becoming saturated.

As space becomes more congested it almost naturally becomes more contested. There are now more than 22,000 objects tracked by the Department of Defense (DoD), of which only 1,100 are active satellites (see Appendix 1).[22] The majority of objects tracked are debris and there are hundreds of thousands of additional pieces of debris too small to track with current sensors. Since debris is not maneuverable it is dangerous to active orbiting satellites; the space debris problem is only getting worse. The number of objects orbiting has more than doubled since 2000. This increase is largely due to the Chinese ASAT test in 2007 and the collision of the Iridium and COSMOS satellites in 2009. The Iridium and COSMOS satellite collision marked the "first accidental hypervelocity collision of two intact spacecraft."[23] These satellite collisions significantly increased the space debris issue, highlight how space is no sanctuary, and illustrate that intentional and unintentional threats are abundant.

The risk of collisions is not the only growing threat. Jamming incidents are also increasing. A 2013 survey by the Satellite Interference Reduction Group reported that

[19] U.S. Department of Defense. *National Security Space Strategy, pp. 1-2.*

[20] United Nations Institute for Disarmament Research, p. 1.

[21] Jonathan O'Callaghan, "How Many Countries Have Rockets Capable of Reaching Space?", *All About Space (on-line).* http://www.space answers.com/space-exploration/how-many-countries-have-rockets-capable-of-reaching-space. This article outlines the number of nations with space launch capabilities. Specifically, it highlights that there are 9 nations with organic space launch capacity (Russia, the United States, France, Japan, China, India, Israel, Iran and North Korea). The Ukraine and South Korea have inherited technology allowing them to make orbital flights and nine other European countries have access to space through the combined effort of ESA and Arianespace.

[22] U.S. Department of Defense, *National Security Space Strategy,* p. 2.

[23] NASA, "Satellite Collision Leaves Significant Debris Clouds". *Orbital Debris Quarterly News,* Vol 13, Issue 2 April 2009. p. 1.

93% of respondents reported suffering from some form of interference.[24] Reports from both Eutelsat and Arabsat show that jamming incidents doubled between 2010 and 2011 and again increased three fold between 2011 and 2012. More alarming to the satellite industry is the increased rate of intentional interference. Arabsat correlated jamming incidents to the Arab Spring and geolocated the interference to Libya, Syria, Ethiopia, and Eretria while Eutelsat reported its jamming incidents primarily arose from Iran, Syria and Bahrain. The increase in jamming incidents caused the satellite broadcast industry to request that the U.N. take action against nation states not actively attempting to stop intentional interference emitting from their territory.[25]

Analysis of the threats indicates the emergence of two trends. First, threats no longer emanate from traditional space powers. New space powers and non-state actors are increasingly the cause of interference. The second trend is that the number of and types of threats are increasing. Russia's ASAT threat is no longer the primary concern to space security. Today, more threats have emerged and run the gamut from satellite jamming to direct ascent ASATs, and target nearly every type of spacecraft to include government and commercial communications, navigation, and imaging satellites. The reality is space capabilities are being targeted daily and space is neither a sanctuary nor peaceful domain. Therefore, policies and strategies that do not address space threats or that simply attempt to maintain space as a peaceful domain are out of touch with reality.

To add to the congested and contested space environment, space is increasingly competitive. While competition is not new in the space domain, what is new is the scope

[24] NewTec. "93% of the industry suffers from satellite interference." NewTec. http://www.newtec.eu/article/release/93-of-the-industry-suffers-from-satellite-interference (accessed Nov 13, 2013).

[25] Peter Horrocks, "Satellite and Internet Jamming Rises as Broadcast Industry Seek to Uphold UN Article 19." BBC (online). http://www.bbc.co.uk/mediacentre/latestnews/ 2012/201112 wsjammingconference.html (accessed Nov 13, 2013).

of the competition and the U.S.'s position in that competitive field. No longer does the competition primarily revolve around the U.S. and the Russia; the competition is now primarily a commercial race. The commercial sector owns or operates more than half the operational satellites in orbit. Furthermore, in spite of NASA draw downs and U.S. military funding cuts, American and international commercial space sectors are growing. Global satellite industry revenues were over $189 billion in 2012, a growth of 6.8% and U.S. revenues grew 8.5%. That significantly outpaces both the global GDP growth rate of 2.3% and the U.S. growth rate of 2.2%.[26] The application of satellite communications has spurred most of the growth. Today, over half of the total satellites in orbit are categorized as communications satellites (see Figure A3).[27] Of those, around 400 satellites are exclusively owned by commercial entities.[28]

However, not all growth is beneficial to the United States. Despite the commercial growth, America is losing its lead in several areas of the space industry, as other nations' space investments and expertise increase.[29] U.S. satellite revenues have seen a downward trend as other states mature technological capabilities and start to build and launch more satellites.[30] Furthermore, because costs to operate in space are dropping, other nation-states benefit from the proliferation of space technologies[31], thus challenging U.S. competitiveness. This shift towards commercial dominance in space and the decreasing edge of the U.S. presents unique challenges to U.S. national security.

Scoping Space Security Challenges

The historical context from which the Cold War shaped the existing space regime,

[26] Satellite Industry Association Report, pp. 4-5.
[27] ibid, 7.
[28] *Communications Satellites,* 9-1-13 Satellite Database
[29] U.S. Department of Defense, *National Security Space Strategy*, p. 3.
[30] ibid, p. 3.
[31] Jeff Kueter, p. 4.

the implications and limitations of the treaties born of that era, and the ever-increasing congested, contested, and competitive space environment all present very real challenges for space security. Those challenges can be categorized into four areas that affect the U.S. and the greater space community. First, the current international space regime is ill-suited to deal with a congested and contested space domain. Second, the security dilemma creates a challenge for balancing protection while avoiding an arms race. The third challenge is balancing support to commercial growth while simultaneously addressing security needs. Finally, the U.S. must address these challenges within the existing fiscal reality and the additional challenges that budget constraints create.

Related to the international space regime, viewing space as a peaceful domain lured the U.S. into heavily relying on cooperation as the primary means for security. Yet, cooperation is sometimes not sufficient in a contested, congested, and competitive environment. National interests conflict, non-state actors are difficult to control, and disagreements over acceptable behaviors abound. Furthermore, the historical space regime and Cold War structure centered space security on a bipolar international system. The increase in nations possessing space capabilities and the proliferation of space threats presents a challenge to the U.S. both diplomatically and militarily.

Diplomatically, the more players the more difficult it is to come to an agreement. In 1967, negotiations of the OST failed to produce compromise between the U.S. and U.S.S.R. on key elements of the treaty. This failure resulted in a treaty with vague language lacking in sufficient detail to direct security efforts. The treaty's vagueness drives debates over the legality of space protection systems to this day. In the future, resolution of those issues will be more difficult because there are many more players interested in advancing their national goals.

From the military perspective, the OST failed to provide any meaningful enforcement mechanisms to stop inappropriate or hostile acts in space. That failure forces each nation to develop "protection" mechanisms. Some mechanisms are passive, but some are active and therefore can be construed as hostile. This creates a security dilemma that will get worse as space becomes more congested and contested and as more states take steps to defend their space assets.

The security dilemma exists because "many of the means by which a state tries to increase its security decrease the security of others."[32] Thus, if others perceive their security is threatened, they may build up capabilities as a response. This behavior can spiral, resulting in an arms race. Much of the dilemma is created because intentions are difficult to verify. What one nation does for defense can be construed as provocative to another. Current treaties, laws, and excepted norms fail to address this dilemma. For example, they do not address legality of defense in space, fail to consider the emergence of non-state actors as threats, and fail thus far to define or even address space weapons beyond WMD. Though the OST and other treaties developed during the Cold War era were pioneering at the time, today they are outdated and insufficient. One legal analyst even suggests, "Applying the Cold War-era Moon and Outer Space Treaties to the modern era of satellites and the War on Terror is like imposing regulations governing Civil War cannons on nuclear weapons."[33]

The increased presence of commercial space technologies in the international space regime also influences the security challenge. Most U.S. commercial satellite providers are part of multinational consortia. While this encourages international

[32] Charles L. Glaser, p. 171. For more detailed discussion of the security dilemma see also Robert Jervis, "Cooperation Under the Security Dilemma," *World Politics* 30, no. 2, (January 1978): 186-214.
[33] Jacob M. Harper, p. 684.

cooperation and establishes trust, it also creates unique security risks. For example, "U.S. troops in Iraq and Afghanistan rely on commercial satellite providers for approximately 80 percent of their communications traffic."[34] Since many of those providers are multinational, signal security becomes more complex because the Department of Defense (DoD) has to use foreign systems to transmit real-world operational data.

The signal security problem also continues to grow as requirements outpace replenishment of old satellite systems with more modern and secure capabilities. The historical precedent of treating space as a peaceful domain and the cost of securing satellite systems once lured many in the space sector to trade security features for increased capability. Thus, many older systems lack encryption and anti-jam capabilities. Although industry standards are starting to address the vulnerabilities, increased requirements will likely out-pace the production of new systems designed with better security functionality.

For example, the remote piloting of Unmanned Aerial Vehicles (UAVs) and employment of UAV-carried sensors and weapons has caused a significant increase to U.S. SATCOM requirements.[35] One report indicated that "in 2009, U.S. UAVs alone generated 24 years worth of video if watched continuously" and the requirement for bandwidth has only grown since then.[36] This increase in SATCOM bandwidth grew much faster than the U.S. could generate newer systems to fill the need. The growth caused an increased reliance on less secure commercial systems. This reliance will continue until the U.S can grow and modernize its space systems to fill the need; however, it is unlikely the U.S. government will ever fully be able to do by itself.

[34] U.S. Department of Homeland Security, p. 3.
[35] Craig Covault, p. 1.
[36] Ibid.

Thus, modernization alone will not solve the security challenge. Heavy reliance on the commercial sector will always exist and the commercial sector will never reach the same level of security that the military sector requires. This is because different stimuli influence the two sectors. Profit drives the commercial sector and security drives the military. For the commercial sector to increase security to meet military standards, satellite providers must add protection measures such as hardening, anti-jam capabilities, redundancies, and encryption. Those added requirements cost money which increases expenses and reduces profits; therefore, commercial companies often accepts risks to increase profits where the military would not. To address the security challenges for the commercial sector, a balance must be identified that increases commercial system security while minimizing the security burden placed on commercial companies.

Shrinking U.S. budgets will also worsen these security challenges. Sequestration is currently set to cut one trillion dollars across DoD and non-DoD programs over nine years."[37] It is unclear how much space programs will have to absorb the budget reductions; however, most agree the cuts will be detrimental to U.S. space programs if the U.S. does not "think and act differently."[38]

Thinking and acting differently means the U.S. must reassess and modify investment strategies. Senior defense officials have testified before Congress that modernization of space capabilities must be part of that investment despite the budget reductions.[39] Officials justify their assessment by citing that modernization is essential to national security because of the evolving strategic environment coupled with the

[37] Aerospace Industry Association, "The Economic Impact of Sequestration on Civil Space Programs." accessed Feb 15, 2014, http://www.aia-aerospace.org/assets/FINAL_Booklet_Copy_of_NASA_NOAA_Space_Report_ 2.11.12.pdf. p. 2.

[38] Tyrone Marshall, "DoD Officials Detail $1 Billion in Space Program Savings." American Forces Press Service (online), Apr 26, 2013. http://www.defense. gov/news/newsarticle.aspx?id=119889 (accessed Feb 8, 2014).

[39] Ibid.

challenges created by an increasingly congested and contested space domain.[40] However, modernization alone will not address all the national security issues and the DoD still has not identified a strategy for balancing budget reductions, modernization needs, and new security requirements.

The civil space industry is also struggling with the budget reductions and some of their concerns link directly to national security capabilities. One Aerospace Industry Association report on civil space programs referred to the sequestration cuts as the "single greatest threat to our space program's continued success."[41] Among the problems identified in the report is the loss of technical expertise within the space community. The report highlights that the "collapse in our technical workforce could lead to a major loss in current national capability."[42] The loss of the space industrial base will have a significant negative effect on both the space community and on future U.S. national security because of its potential to derail future security investments.

Fiscal limitations also create challenges when dealing with the security dilemma. Historically, the U.S. has attempted to protect space assets primarily through the use of defensive capabilities. However, as offensive capabilities improve and the budget decreases, offensive systems may become more attractive. This is because based on current technologies offensive systems cost less to procure and are more effective than defensive systems; however, they also tend to be more destabilizing.[43] Thus, the challenge for U.S. strategy is in finding a balance between the two.

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[40] Ibid.

[41] Aerospace Industry Association, p. 2.

[42] Ibid.. p. 2.

[43] James D. Fearon, "The Offense-Defense Balance and War Since 1648." Paper presented at the Annual Meeting of the International Studies Association, Chicago, IL, 1995. p. 1. Robert Jervis, "Cooperation Under the Security Dilemma," pp. 186-214. Jervis points out that when offense has the advantage over defense in military technology, "status-quo powers must then act like aggressors; the fact that they would gladly agree to forego the opportunity for expansion in return for guarantees for their security has no implications for their behavior." p. 169.

Fiscal challenges also affect the ability of the DoD's acquisition community to meet the growing operational demands. The DoD does not have sufficient funds to address all the security concerns. Additionally, government fiscal cuts and budget uncertainty force contractors to accept more risk during system development. As a result, program costs and delays are increasing and capabilities are decreasing. This downward cycle wreaks havoc on the DoD's acquisition community and increasingly resulted in delays, program cuts, and failure to deliver needed security capabilities.

The U.S. spacefaring strategy must address these fiscal realities while mitigating the security challenges. Success requires the U.S. to identify a strategy that addresses these issues and sets America on a path towards spacefaring security. Failure to do so will diminish vital U.S. capabilities and threaten U.S. national security.

Assessing the Current Space Security Strategy

Establishing a conceptual framework is essential for developing and executing such a strategy.[44] One commonly used framework is the ends, ways, means, and risk model. This model helps conceptualize the major components of strategy, emphasizes the linkages between them, and highlights the need to balance the elements to mitigate risk. However, the ends, ways, means, and risk model alone is not sufficient for developing and evaluating complex strategies. A good strategy will also have several key characteristics. Dr. Richard Rumelt, a professor of Business and Society at the UCLA Anderson School of Management, studied these characteristics for years. In *Good*

[44] Paul B. Eberhart, "Grand Strategy of the United States: A Study of the Process." Master's Thesis. Joint Forces Staff College (25789), 2009. http://www.dtic.mil/dtic/tr/ fulltext/u2/a530097.pdf (accessed 24 Feb, 2014), pp. 18-20. This document outlines approaches for framing strategy. Arthur Lykke and Henry Bartlett both developed models to visualize the relationship between the desired end states (ends), the concepts for getting there (ways), the resources requirements (means), and the risks associated with balancing the ends, ways and means. A good strategy must address and balance all those elements.

Strategy/Bad Strategy, he analyzed several characteristics of both good and bad strategy. Among other things, he contends that a good strategy addresses a specific problem, leverages coherent action, and looks for advantages and opportunities.[45] Likewise, Rumelt identified several characteristics of bad strategy. Those characteristics included fluff, failure to face the challenge, mistaking goals for strategy, and setting bad strategic objectives.

Applying the end, ways, means, risk model and Rumelt's concepts to the current NSSS shows the current strategy is insufficient in both its parts and as a whole. The strategy cannot be broken down into its perspective components nor does it adequately address the changing strategic environment or resource constraints. Therefore, it cannot focus strategic efforts to address the new environment. Likewise, the current NSSS is not a "good strategy." The most glaring shortfall of the current NSSS is that it is largely a compilation of broad strategic goals with little discussion of how the objectives interrelate with the recommended actions or needed resources.

Because of these deficiencies, the current NSSS is insufficient and a new strategy is required. The new strategy must balance ends, ways, means, and risk. It must provide a more cohesive approach for securing space activities and build a plan that leverages U.S. advantages and opportunities. Finally, it must address resource constraints. Using the ends, ways, means, and risk model and Rumelt's concepts will ensure the U.S. strategy highlights those issues and effectively addresses needed improvements for U.S. space security.

[45] Richard Rumelt, *Good Strategy Bad Strategy: The Difference and Why it Matters.* (New York: Crown Business Publishing, 2011), pp. 77, 94, 97-98, 142, 160.

CHAPTER 3: A NEW SPACEFARING SECURITY STRATEGY

> *"Strategy is a fancy word for a roadmap for getting from here to there, from the situation at hand to the situation one wishes to attain…it is the intellectual connection between the things one wants to achieve, the means at hand, and the circumstances."*[1]
>
> - Codevilla and Seabury, War: Ends and Means

National security strategies provide comprehensive frameworks for organizing whole-of-government efforts to achieve national security. These strategies provide direction and inform not only the national security structure but also other federal, private, and international organizations to create strength through cooperation and unity of actions. The range of security strategies should work together and complement each other. One way to synchronize the strategies is to ensure their desired end-states and strategic objectives are complementary. Thus, it is important to coordinate the strategies and structure them so they can easily draw correlations.

A national strategy for securing space activities should therefore interact with and help influence the U.S. National Security Strategy as well as national strategies focusing on homeland, aviation, and maritime security. Linking the Space Strategy to the Homeland, Aviation, and Maritimes Strategies will also help normalize space security efforts by building from lessons learned in the other domains. For example, when examining and comparing existing strategies to the current space strategy, the current strategy continually referenced the entirety of the space domain instead of focusing on the activities and systems operating in the space environment. Even the name of the strategy focused on the domain rather than the U.S. interests within the space domain. Part of developing a new strategy is to focus the scope of the strategy. Thus, a new

[1] Paul Seabury and Angelo Codevilla. *War: Ends and Means.* (New York: Basic Books, 1989), p.97.

security strategy should focus on spacefaring rather than the entirety of space. It should include the launching to and travel in space. For the remainder of this paper, spacefaring is defined as the operation of spacecraft from earth to space and within the space domain. The new strategy for is titled The National Strategy for Spacefaring Security. This better aligns the strategy and enable focused coherent action.

End-States, Enduring Principles, and Strategic Objectives

With the scope of the strategy established, the next step is defining the desired ends, enduring principles, and strategic objectives. Unfortunately, the existing National Space Policy and previous NSSS do not articulate a clear vision or desired ends. The documents outline numerous vision statements for space activities, but there is no concise definition to focus strategic efforts. Therefore, the following statement articulates a single, clear end-state as the basis for strategy development. The statement is an amalgamation of various current goals, objectives and priorities. The desired end-state for spacefaring security is "*The long-term goal of the U.S. is the secure, unencumbered and sustainable use of space by the Nation, the international community, and the legitimate commercial sector."*

This desired end-state is a reflection of enduring space principles. Enduring principles are the values that define how the U.S. views the use of space. They shape the options available to the strategist because the ways and means must support the values of the U.S. or the strategy fails. In the case of space operations, there are four enduring principles that shape space policy and strategy. They are: (1) the secure use of space is in the best interest of all spacefaring nations; (2) free access to and use of space is the right of all nations; (3) the long-term sustainability of the space domain is in the best interest of both spacefaring and space-benefiting nations; and (4) since all nations benefit

from the safe and secure use of space, all nations must share in the responsibility.

The desired end-state and principles help the strategic objectives. The strategic objectives are the plans for achieving security (the ways). Essentially, the strategic objectives are used to focus efforts and address all major problem areas associated with security. The new strategic objectives are meant to focus effort on specific concerns associated with operating in a congested, contested, and competitive space environment. Furthermore, they are designed to clearly align with the Homeland, Aviation, and Maritime Security Strategies. The five new Spacefaring Security Strategy objectives are to: (1) establish mechanisms for securing U.S. capabilities; (2) mitigate damage and expedite recovery; (3) deter and prevent attacks on space systems and associated critical infrastructures; (4) strengthen the international foundation to ensure long-term U.S. success; and (5) safeguard space as a global resource.

Figure 1 outlines the strategic objectives for the Homeland, Maritime, Aviation and Spacefaring Security Strategies.[2] It illustrates how objectives between the strategies are synchronized while still focusing on specific security concerns within the respective domains. For example, the Spacefaring Security Strategy is the only strategy with an objective of establishing mechanisms for securing U.S. capabilities because there are already broad internationally recognized control mechanisms and norms for maritime and aviation security. No such mechanisms or established norms exist for spacefaring security, so the Spacefaring Security Strategy objectives include requirements to normalize, standardize and enforce space security standards.

[2] George W. Bush, National Strategy, *National Strategy for Homeland Security*. (Washington, D.C, U.S. Homeland Security Council, 2007): p. 1; George W. Bush, National Strategy, *National Strategy for Maritime Security,* (Washington, D.C.: Executive Office of the President, 2005): p. 7; George W. Bush, National Strategy, *National Strategy for Aviation Security.* (Washington, D.C.: Executive Office of the President, 2007): p. 12.

Figure 1 Domain Synchronized Strategic Objectives

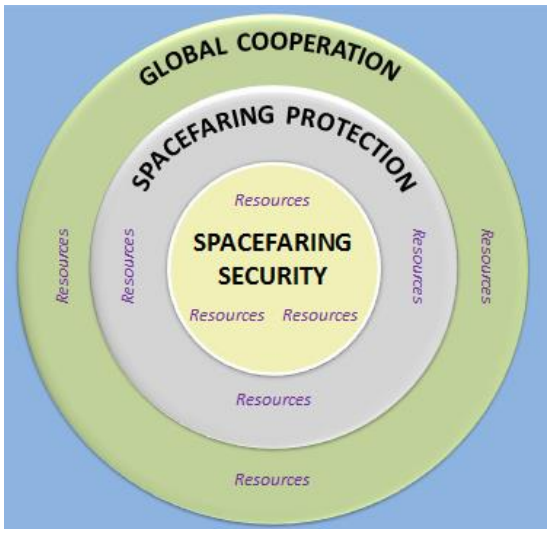
A New Spacefaring Strategy Model

The new security objectives represent a significant revision from previous strategies. Beyond creating linkages to the other national security strategies, the new objectives frame the desired ends while addressing strategic problems. Previous strategic objectives were largely rewritten goal statements that failed to address the major security issues. The revised objectives connect the current and desired ends by addressing the major problems associated with getting from one to the other.

The objectives shape the strategic approach. The strategic approach connects the ends, ways and means. According to Arthur Lykke, the approach must include "a definition; a description of the basic elements that make up military strategy; and an analysis of how they relate."[3] Although Lykke was discussing military strategy, the

[3] Arthur F. Lykke, "Towards an Understanding of Military Strategy." *U.S. Army War College Guide To Strategy* (Feb 2001), p. 179.

concept equally applies to all levels of strategy. Using this concept, a model was developed that nests the ways and means within a cohesive strategic approach. Figure 2 shows the spacefaring security model.



The strategic model consists of three nested layers designed to achieve desired objectives. Those layers are spacefaring security, spacefaring protection, and global engagement. Each layer requires unique but interdependent resources to achieve the objectives. In the model, the layers represent the strategic ways and the resources represent the means. Because the ways and means should be interlinked, gaps in either create risk as outlined in Figure 3.

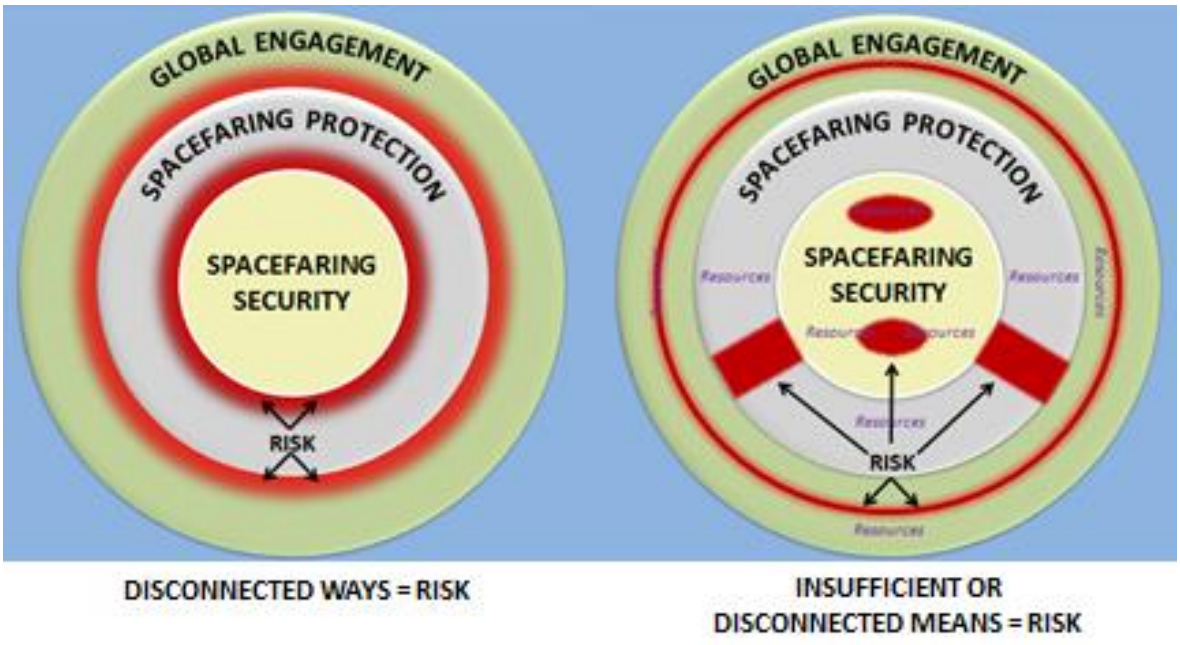


Figure 3 Risks to Spacefaring Security

Defining the model further, spacefaring security represents those measures taken to assure safety through avoidance or mitigation of threats. Those threats can be either

intentional or unintentional threats to space systems to include associated ground infrastructure. Spacefaring protection represents those measures taken prevent or respond to an attack. Protection is necessary when security measures fail. The current concept of *space* protection is different from *spacefaring* protection because the spacefaring strategy differentiates security from protection whereas current concepts do not. Global engagement represents the commitment and action of the international community to enforce security norms and protection efforts. The strategic desired end state requires closing the ways and means gaps. Those gaps exist when the ways are not in connection, when there are insufficient means, or when means are not connected.

The linkages between the three ways are critical to understanding the strategy. Security is at the center of the strategy because without security, protection, and global engagement efforts cannot be focused. Protection is in the middle because both security and global engagement are heavily influenced by protection. Global engagement involves interaction with the international community and commercial sector to share security and protection responsibilities, establish standards and norms, and build enforcement mechanisms. The goal of the strategy is for either security measures or global engagement efforts to prevent or mitigate threats; however, if those elements fail the U.S. must act to protect its space capabilities.

The long-term goal of the strategy is to minimize the protection layer while simultaneously growing its effectiveness. Shrinking the protection layer is fundamental to mitigating the security dilemma. This is accomplished by increasing security capabilities and improving global engagement effectiveness. As security increases, the need for protection activities should decrease. Likewise, as global engagement mechanisms improve, then the need for protection should also decrease. By improving

security and global engagement capacity, the U.S. can use protection resources more efficiently. To apply this concept, a better understanding of each layer is required.

Spacefaring Security

The heart of any good security strategy should be security. Spacefaring security is freedom from danger; it assures safety of operations in and through space. While no strategy can guarantee safety, the goal of spacefaring security is maximizing the benefits from space while simultaneously minimizing risk. The major elements of the spacefaring security are space domain awareness, layered security, and domestic and international cooperation and integration. These three components work together to mitigate the risk of natural or man-made threats to space systems. Figure 4 illustrates the major elements of space security.

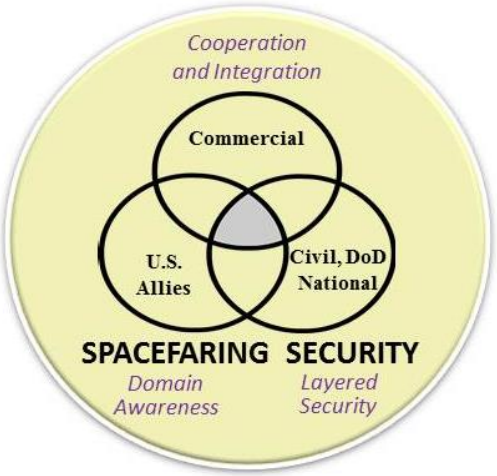


Figure 4 Spacefaring Security Elements

To conceptualize the security component, consider a home security strategy. The homeowner likely keeps a watchful eye on the house and is aware of the street and local area's normal environment. They likely watch the news to maintain awareness of any increased threats in the area and discusses threat mitigation with the family. As part of that discussion, the homeowner likely outlines a layered security approach to keep the home secure. The layered security may include putting up blinds, placing thorn bushes under windows, and locking the doors and windows. The homeowner may hire a security company to monitor the home remotely via a security system, and may participate in a neighborhood watch program in an effort to cooperate with neighbors. In summary, the homeowner is aware of the surroundings,

uses a layered security approach to secure the home, and cooperates with others to improve his security and the security of others. These security elements apply to spacefaring security as well.

Domain Awareness

The most important of the three spacefaring security elements is domain awareness. Security requires awareness of the space domain, knowledge of the potential threats, and an understanding of how to mitigate those threats. These elements are consistent with concepts identified in the other domain security strategies. For example, the National Strategy for Maritime Security states, "A key national security requirement is the effective understanding of all activities, events, and trends within any relevant domain—air, land, sea, space, and cyberspace—that could threaten the safety, security, economy, or environment of the United States and its people."[4] It goes on to state awareness and threat knowledge are critical for securing the domain. Thus, domain awareness is important because it provides a foundation for the other elements.

It is also the most difficult element because of its scope. Understanding the space environment, potential threats, and being able to assess mitigation efforts is a complex and formidable task. It requires global collection of satellite data, assessment of that data, and distribution of the information to a wide spectrum of space users both domestically and internationally. The scope of this task requires cooperation and integration with the greater spacefaring community.

Layered Security

In addition to domain awareness, the U.S. must establish a layered security

[4] George W. Bush, National Strategy, *National Strategy for Maritime Security,* (Washington, D.C.: Executive Office of the President, 2005): p. 16.

architecture. Since any single safeguard mechanism may be flawed, a series of different, overlapping measures must be used to cover gaps and provide redundancy across multiple systems and multiple users.[5] The implementation of layered security for space operations requires that all owners and operators take responsibility for securing their systems. Each owner and operator must put in place multiple, standardized measures for safeguarding their systems and those measures must apply across the spectrum of space assets to provide redundancy and eliminate seams. Since each owner and operator is responsible for their own security, the U.S. government must establish standards. Standards will help ensure there are not multiple, discombobulated and unstandardized security mechanisms and simplify identifying gaps in the overall architecture. Execution of a standardized layered security approach will defend against accidents and establish expectations for responsible behavior.

Cooperation and Integration

Cooperation and integration of the domestic and international spacefaring communities is the final step in piecing together a security architecture for U.S. space operations. Cooperation must include the major U.S. space sectors and the international space community. In space, one accident or irresponsible incident can potentially affect spacefaring operations globally. Cooperative security means that all spacefaring nations and commercial institutions actively take responsibility for sharing domain awareness information and securing their space systems.

However, cooperation is not enough given the scope of the security problem, the speed at which incidents unfold, and the potential for those incidents to cascade into

[5] Chad Perrin, "Understanding Layered Security and Defense in Depth.", TechRepublic (online). Dec 18, 2006. http://www.techrepublic.com/blog/it-security/understanding-layered-security-and-defense-in-depth (accessed Feb 12, 2014).

multiple harmful events. For example, an accidental space collision can produce hundreds of pieces of space debris that have the potential to impact dozens of satellites within a matter of hours. Any additional impacts could then generate more debris creating a cascade of incidents affecting multiple satellites and satellite users. Thus, spacefaring security requires an integrated approach. Integration of the security architectures creates a global capability more robust than any individual security mechanism. It enables rapid detection, identification, and response to incidents. Ultimately, the cooperation and integration mechanisms are needed to synchronize space domain awareness and layered security elements.

Spacefaring Protection

Unfortunately, security is rarely enough. When security fails there needs to be a mechanism in place to respond. That response is spacefaring protection. Protection must focus on deterring or denying adversaries when security is not sufficient to stop aggression. The difference between security and protection is important. For one, spacefaring protection does not protect systems from environmental threats. Security measures are responsible for defending space systems against environmental or unintentional threats. Another difference is that nation states are responsible for spacefaring protection. Thus, not everyone is authorized to take protection measures. Within the U.S., spacefaring protection is the responsibility of the DoD. Reference again the home safety analogy. Once the homeowner has secured the home, if the security company detects an intruder, the police are dispatched to protect the homeowner, the family, and potentially the home itself. Police are not called when a hailstorm threatens the home, because protection assets focus on adversarial threats.

Deterrence underpins spacefaring protection. Deterrence depends on the U.S. signaling to potential adversaries that the cost of attacking U.S. systems is greater than any potential benefits. Deterrence theory requires a credible, capable, and committed approach to stop or deny an adversary the ability to harm.[6] Refer back to the home intrusion scenario again. If an intruder knows there is a credible risk that the police will be notified and respond and they are committed to doing so quickly, then the intruder will likely not attack the home because the risk of being caught is too great. However, if the intruder does attack the home, the goal is for the police to have the capability to stop the attack and penalize the intruder. For space, the U.S. government must establish a credible, capable, and committed deterrence ability for protection to be successful. The concept of using deterrence for space protection is not new. Both the 2006 and 2010 National Space Policies focused deterrence for space activities.[78] Previous space strategies even assigned the task to DoD.[9] What is new about deterrence as part of a Spacefaring Security Strategy is the conceptual model structuring the approach around capabilities, credibility, and commitment.

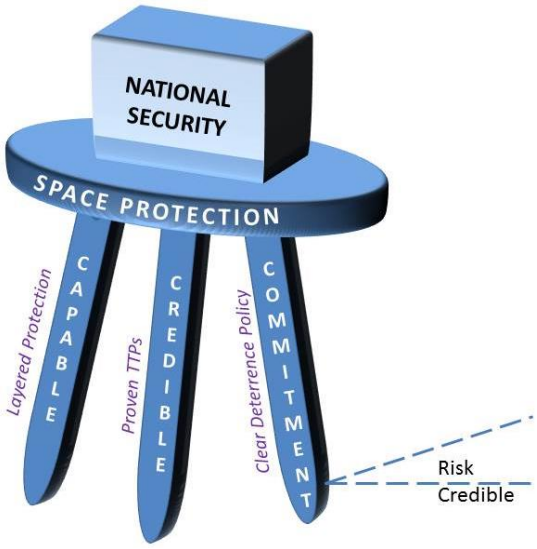


Figure 5 Spacefaring Protection Model

Picture the three elements of deterrence using Lykke's three-legged stool (Figure 5).[10] The three elements of deterrence must work in concert with

[6] Gregory Miller, "International Relations Theory." Lesson slides presented to the Joint Advanced Warfighting School, Norfolk, VA, Joint Forces Staff College, Nov 8, 2013.

[7] Barack H. Obama, National Strategy, *National Space Policy.* (Washington, D.C.: Executive Office of the President, 2010): p. 3.

[8] George W. Bush, National Strategy, *National Space Policy of the United States of America*. (Washington, D.C.: Executive Office of the President, 2006): p. 2.

[9] Ibid, p. 16.

[10] Paul B. Eberhart, p. 18.

each other for the strategy to remain stable. The strategy becomes unstable if it is missing any of the elements, if one element is under emphasized, or if the elements are not accordant with each other. Applying that concept to spacefaring protection, the U.S. must synchronize capabilities (weapon systems), credible tactics, techniques, and procedures (TTPs), and commitment via clearly communicated policy.

Layered Protection

The challenge for the Spacefaring Security Strategy is balancing the security dilemma associated with the reality of space threats and the existence of space weapons. The security dilemma is if the U.S. develops weapons to deter aggression, others may view that as a threat and therefore become more aggressive. Alternatively, if the U.S. does not develop space weapons capabilities, adversaries could seek a strategic advantage and develop weapons first. Because of the security dilemma, it is best to layer the protection systems to minimize the perception of a space arms race while still demonstrating that willingness to protect U.S. systems.

Layered protection requires two things: proportionality and depth. As highlighted above, not all threats are equal. Thus, the mechanisms to protect against those threats will not be equal. Likewise, not all satellites are equal in importance and, therefore, the mechanisms for protecting those systems should be different. These differences create a need to develop layers capable of addressing the variety of threats and protecting a variety of systems. This paper does not directly address the capabilities themselves due to concerns of classification, but does discuss the types of layers.

The layers must span the spectrum of responses to include electromagnetic capabilities, physical denial systems, and replenishment. The layers must include reversible and nonreversible means and be proportionally reciprocating. This means

protecting against jamming should use non-kinetic, reversible means, but protecting against an ASAT could include the ability to destroy the ASAT. The layers must also be proportional in significance and cost to the item protected. Therefore, space systems and associated infrastructure must be categorized based on importance and the means for responding should be proportional to the criticality of the system. For example, jamming of commercial television over the U.S. may include counter-jamming combined with diplomatic measures whereas bombing U.S. ground stations may include counter-strikes.

It is important to note layered protection capabilities do not mean layered space capabilities for the DoD. The layers must include both ground-based and space-based assets. Space based assets provide unique capabilities and cost benefits. However, the development of any space based system must include a level of transparency to mitigate mistrust and misperceptions. Layered protection efforts also require standardized across the spectrum of strategic capabilities. At least within the DoD and national agencies, protection responses must be clearly understood, exercised, and updated. Additionally, the DoD must work with commercial satellite providers and U.S. allies to aid in their protection efforts and help develop international protection capabilities. Effective layered protection requires this type of multilayered, multiuser approach.

Tactics, Techniques, and Procedures (TTP)

To execute effective spacefaring protection actions, the DoD must have credible TTPs for employing its systems. Credible TTPs mean establishment of innovative methods to defend U.S. space systems against a wide variety of threats. It also requires operators trained and ready to execute the TTPs. Implementing spacefaring protection TTPs requires that acquirers take responsibility for TTP development and senior leaders be prepared to employ protection systems. Furthermore, policy makers and senior DoD

leaders must ensure the TTPs are exercised and that measures are in place to quickly identify threats, determine an appropriate response, and then execute protection activities. This requires that all stakeholders understand the consequences of the measures taken and that the U.S. is transparent when executing defensive capabilities.

Clear Deterrence Policy

The American expectation for protection must be clearly articulated in a policy that includes U.S. expectations for application of force. The current National Space Policy states "Purposeful interference with space systems, including supporting infrastructure, will be considered an infringement of a nation's rights."[11] What does that mean or what should it mean? The law of proportionality stipulates that SATCOM jamming or spoofing does not normally constitute the right to bomb a nation's sovereign territory. However, the U.S. should have the right to bomb another nation's territory if the spoofing caused an airliner to crash into a U.S. airport killing American citizens. However, what if an ASAT destroyed a GPS satellite? It is unclear whether that would constitute the right for a kinetic response. Likewise, if the GPS example happened overseas and foreigners were killed, it is unclear what actions would be considered "proportional" for a U.S. response. The point is there is no policy, international law, or customary law that addresses those issues sufficiently. Therefore, the U.S. must create the standard by taking a firm position in a U.S. space deterrence policy.

Deterrence only works if the adversary believes there is a credible capability and that the U.S. is committed to the policy. That requires clear communication; therefore, the U.S. National Space Policy must continue to emphasize deterrence in order to show it is committed to preventing irresponsible behavior in space. The policy must articulate

[11] Barack H. Obama, p. 3.

credible capabilities the U.S. intends to employ in response to space threats. In turn, the U.S. must openly exercise those capabilities.

Global Engagement

The final element of the new Spacefaring Security Strategy is global engagement. Global engagement is critical for the success of spacefaring security and spacefaring protection because it engages with the international community and commercial sector to share effort and resources, establish standards and policies to enforce responsible behavior, and aid in environmental protection. It represents the commitment of the greater space community to enforce security standards and protection efforts. Such support is essential to the success of any spacefaring strategy. Global engagement efforts fall into three categories, standards development, enforcement and shared responsibility.

Established Standards

Establishing global standards will not be easy but it is necessary to ensure long-term national security. As the nation benefiting and dependent on space capabilities the most, it is a vital United States' interest to promote the responsible, peaceful, and safe use of space. Establishing standards allows the U.S. to lead the efforts in endorsing those principles. Likewise, it is in the U.S. interest to extend global standards beyond those general principles; those standards must address both spacefaring security and protection requirements.

International policies and laws must clearly outline security and protection requirements. At a minimum, those standards should include basic security criteria for satellites and ground infrastructure, coordination and data sharing requirements, satellite sovereignty rights, and defining legal and illegal space weapons. Working through these

issues and establishing agreements amongst the key spacefaring stakeholders will not be easy. Each stakeholder has a major role in establishing and endorsing international policies and most have differing and passionate views on the issues. Nonetheless, all effort should be made to establish clear and detailed standards and develop enforcement mechanisms. Doing so will help mitigate mishaps, misperceptions, and mistrust and ultimately improve U.S. national security.

Establishing Enforcement Mechanisms

Once international standards are established, there must be enforcement mechanisms to ensure spacefaring nations adhere to the standards. That requires the standards and enforcement mechanisms be clearly established in international law. Furthermore, each nation-state must take responsibility for enforcing those standards which requires changes to the existing space regime.[12]

Recognizing regime change takes time; the U.S. must not wait for a diplomatic solution. It should lead by example and establish standards and enforcement mechanisms for the U.S. government and commercial space sector. The U.S. should continue to engage with the international community while maintaining transparency in U.S. spacefaring security and protection policies and standards. Promoting dialogue with the international community can help solicit support by increasing trust and may aid in negotiating international agreements in line with U.S. policies.

Shared Responsibility

Global engagement also requires building international support for and capacity to share security and protection responsibility. The concept of shared responsibility comes

[12] Everett C Dolman, p. 88. Dohlman states "changes in principles or norms, however, do require the acceptance or establishment of a new regime."

from the idea that no one nation can or should bear sole responsibility for security or protection of global commons. Thus, since space is a shared domain, the global community must share in its protection and enforcement of international norms within it.

The 2010 and 2014 Quadrennial Defense Reviews (QDR) enforced that concept. The 2010 QDR directed the DoD to "explore opportunities to leverage growing international and commercial expertise to enhance U.S. capabilities and reduce the vulnerability of space systems and their supporting ground infrastructure."[13] The new 2014 QDR continues that theme by stating "the Department's initiatives in space will continue to be underpinned by U.S. Government efforts to work with industry, allies, and other international partners to shape rules of the road in this domain."[14] However, simply establishing rules of the road is not enough. The U.S. must also advocate for the establishment of an International Organization to create, monitor, and enforce standards. That goes beyond what any current International Organization does today.

Such an organization can facilitate sharing responsibility for space security. That requires a establishment of a global architecture to coordinate, collaborate, and integrate spacefaring security and protection programs. More than in any other domain, actions in space affect all nations. However, there is no need to duplicate efforts across all nations if they can share. As a minimum, the global architecture must include the continued deconfliction of orbital slots and radio frequencies, integrated domain awareness systems, robust satellite disclosure processes, intelligence sharing capabilities, civil space collaboration, and cost-sharing programs. These efforts are designed to share costs, capabilities, and competencies across multiple nations and international organizations

[13] U.S. Department of Defense. 2010 *Quadrennial Defense Review Report*, by Secretary of Defense Robert Gates. (Washington, D.C.: Department of Defense. 2014), p. 33.

[14] U.S. Department of Defense. 2014 *Quadrennial Defense Review Report*. by Secretary of Defense Chuck Hagel. (Washington, D.C.: Department of Defense. 2014), p. 20.

thereby allowing all nations to contribute to the improved security of the space domain and support enforcement of global standards.

The Complete Spacefaring Security Model

Global engagement enables the orchestration of spacefaring security and spacefaring protection on a global scale; together, these elements create a focused, global approach to defending America's interests in space. Furthermore, the Spacefaring Strategy provides a cohesive methodology to allow the U.S. to focus limited resources while simultaneously addressing a wide range of challenges. The nested approach blends U.S. government and commercial activities and works towards establishing the necessary capabilities, policies, and organizations to improve spacefaring security for all nations. Although each layer requires unique resources, the layers are interdependent and support each other. In other words, the ways and means support the desired ends. Figure 6 is a complete picture of the new Spacefaring Security Strategic Model.

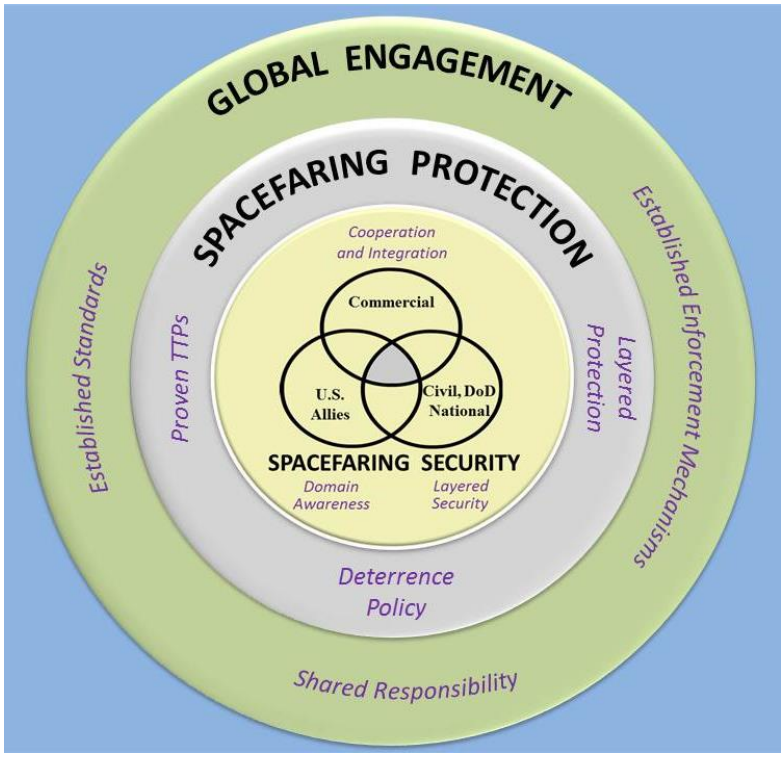


Figure 6 Complete Spacefaring Security Strategy Model

CHAPTER 4: SETTING CONDITIONS FOR SPACEFARING SECURITY

> *"The Department will pursue a multi-layered approach to deter attacks on space systems while retaining the ability to respond, should deterrence fail. This will require continuing to develop capabilities, plans, and options to defend against and, if necessary, defeat adversary efforts to interfere with or attack U.S. or allied space systems."*[1]
>
> 2014 Quadrennial Defense Review

The shift to a National Strategy for Spacefaring Security requires a paradigm shift in traditional space security doctrine. Implementing the strategy requires commitment from the U.S. to change how it uses its instruments of national power to secure space systems and capabilities. The U.S. must focus efforts and close the ways and means gaps, develop diplomatic conditions to improve U.S. defense capabilities, shape the information environment to minimize misperceptions and mistrust, and incrementally improve spacefaring protection programs.

Recommendation 1: Develop Supporting Implementation Plans

One of the biggest mistakes in implementing strategy is failure to translate the strategic approach into actionable plans. Successful implementation of the National Strategy for Spacefaring Security requires the U.S. to develop subordinate plans to focus efforts and close the ways and means gap. Development and execution of subordinate plans requires a Coordinating Committee to take responsibility for managing plan execution and to link the various plans together to achieve coherent action.

The use of subordinate plans to implement strategy is consistent with how the U.S. executes the Aviation and Maritime Security Strategies.[2] Recommendations for subordinate spacefaring security plans should emulate those plans as much as possible

[1] U.S. Department of Defense. 2014 *Quadrennial Defense Review Report.* by Secretary of Defense Chuck Hagel. (Washington, D.C.: Department of Defense. 2014),p. 20.

[2] George W. Bush, National Strategy, *National Strategy for Maritime Security,* (Washington, D.C.: Executive Office of the President, 2005): p. 2.

while focusing on the ways and means for executing the Spacefaring Security Strategy. Subordinate plan development will require a collaborative interagency effort with input from all spacefaring stakeholders. Additionally, those plans should link together and reinforce each other. At a minimum, the U.S. should develop a National Plan to Achieve Space Domain Awareness (SDA), a Spacefaring Operational Threat Response Plan, a Spacefaring Commerce Security Plan, and a Spacefaring International Outreach and Coordination Strategy.

The SDA plan is necessary to address Spacefaring Security challenges. The SDA plan should lay the foundation for understanding the major SDA components and direct component integration. The SDA plan must outline standardization criteria for integrating Space Situational Awareness data into the SDA architecture. The SDA plan should also outline how to integrate all available intelligence regarding potential threats and outline threat detection and identification processes and reporting requirements.

Threat reporting is insignificant if there is no response. Thus, the Spacefaring Operational Threat Response Plan must direct Spacefaring Protection activities. The Threat Response Plan will facilitate a coordinated U.S. government response to threats against U.S. space systems and interests in the space domain. The Response Plan must establish roles and responsibilities and identify anticipated response options. The plan must address international notification of actions to facilitate the transparency of spacefaring protection. Thus, the goal of the plan should be to enable quick, decisive and transparent action.

The Spacefaring Commerce Security Plan will establish a comprehensive plan to secure commercial space activities and systems. The goal of the Spacefaring Commerce Security Plan is to improve and standardize commercial spacefaring security mechanisms

to lower the risk that adversaries will target commercial assets and damage U.S. national security or American interests. The plan should also identify domestic outreach mechanisms to engage non-Federal organizations to aid in the development and implementation of spacefaring security policies.

Finally, a Spacefaring International Outreach and Coordination Strategy focuses on enabling global engagement. The Outreach and Coordination Strategy will ensure there is a framework to coordinate spacefaring security and protection initiatives with foreign governments and international organizations. Outreach efforts should solicit international support for enhanced spacefaring security. Furthermore, it helps mitigate the risk of misperceptions regarding the scope and purpose of spacefaring protection systems.

These plans are essential to the successful implementation of the National Strategy for Spacefaring Security. The plans are necessary to focus efforts and ensure the strategy is supported by the whole-of-government. Furthermore, development and implementation of these plans support the next series of recommendations.

Recommendation 2: Withdraw from the Outer Space Treaty and Invest in a New Space Regime

Implementation of the strategy, and development of a Spacefaring Operational Threat Response Plan, requires the U.S. to address the use of weapons for spacefaring protection. This will spark concern over space weaponization and the debate about an arms race in space. Addressing international concerns requires treaty updates or new laws that address defending space assets in a congested, contested, and competitive space domain. That will be difficult under the current space regime; withdrawing from the Outer Space Treaty will force an investment in a new space regime. The U.S. should

announce it intends to withdraw from the treaty but leave sufficient time to allow for establishment of a new space regime that embraces global engagement in the new space environment. Although treaty withdrawal may seem radical, it is the most effective and least harmful diplomatic option available to the United States.

As the cornerstone of space law, the OST should address protecting space systems. Instead, the treaty's vague, incomplete, and outdated language is an impediment to progress. Efforts to update the treaty stagnated and debates over space weapons and concern of an impending "space arms race" persist.[3] These debates prevent the U.S. from developing a comprehensive and transparent spacefaring protection policy. Furthermore, U.N. negotiations over international legal and regulatory reforms have deadlocked resulting in little change to the much outdated space regime.[4] This deadlock makes U.S. space diplomacy efforts increasingly difficult. These challenges will continue if something does not change.

A withdrawal from the OST will create that change. At the very least, it will use diplomatic pressure to prioritize renegotiation of a new space regime. Today, the OST does little to support U.S. interests other than banning placement of WMD in space or on celestial bodies. Since U.S. withdraw will allow sufficient time to establish a new regime, which the U.S. must insist supports a no WMD international norm, there is little value for the U.S. in staying in the treaty. Best case, new negotiations will allow for some level of spacefaring protection and build mechanisms for enforcing responsible behavior in space. What is more likely is that diplomatic negotiations will yield new laws that address satellite operations and security requirements for operating in a

[3] Ben Rusek, "The Outer Space Treaty at a Glance." Arms Control Association (online). https://www.armscontrol.org/factsheets/outerspace (accessed Feb 17, 2014).

[4] Marshall Institute. "Space as a Vital National Interest.", Marshall Institute Policy Outlook (online). August 2005. pp. 3-4. http://marshall.org/wp-content/uploads/2013/08/315.pdf.

congested domain; however, there will likely be no agreement on space weapons. Debate at least allows the U.S. to open the dialog and publicly establish U.S. policies for spacefaring protection.

Not everyone believes it is necessary to force the weapons debate to address the legitimacy of developing spacefaring protection capabilities. One could argue that since the OST only bans WMD, then the U.S. is authorized to develop space weapons and, therefore, the U.S. does not need to have the discussion. However, this perspective fails to recognize the need for global support. By failing to force international discourse, the U.S. cannot build support for global security initiatives.

There have been numerous discussions at the U.N. regarding using diplomacy instead of weapons as the means to deter aggression. That discussion focuses on building deterrence capabilities through cooperation and international law to mitigate the security dilemma.[5] Those debates lead to illusions of security through mutual vulnerability, which has already proven ineffective. While the U.S. should continue to support discussions regarding diplomatic solutions for mutual defense, the U.S. should not rely exclusively on diplomacy for self-defense.

That was the very rationale behind U.S. withdrawal from the Anti-Ballistic Missile Treaty. Initially there was concern over the potential political downfalls of the withdrawal; however, ten years later, experts claim the action as a positive for both U.S. security and political maneuvering capabilities.[6] That is the goal of a U.S. withdrawal from the OST. There must be an impetus for diplomatic negotiations. Those negotiations are essential to allow political maneuvering, gain support of improved

[5] Nandasiri Jasentuliyana, *International Space Law and the United Nations.* (Netherlands: Brill Academic Publishers, 1999), p. 73.

[6] Heritage Foundation Lecture. "The 10th Anniversary of the Anti-Ballistic Missile Treaty Withdrawal," Washington D.C.: Heritage Foundation Lecture No. 1220, Jun 13, 2012. pp. 1, 7.

spacefaring security, and openly address spacefaring protection.

Recommendation 3: Build A Robust Spacefaring Security Architecture

The heart of the Spacefaring Security Strategy is security, thus the preponderance of effort must be in building a robust spacefaring security architecture. For the other domains, solid security mechanisms already exist. That is not the case for space. The U.S. must address shortfalls by establishing security systems and processes, yet the U.S. government cannot and should not assume all spacefaring security functions. Fortunately, a number of traditional and non-traditional actors, such as the commercial community, expressed an interest in developing processes and tools aimed at enhancing spacefaring security and the U.S. must support and channel these efforts.[7]

Establish Security Standards

First and foremost, the U.S. should work with the wider space community to develop and implement standardization of security systems. The U.S. must first develop standardize procedures and threat mitigation responses to improve information flow and minimize mishaps, misperceptions, and mistrust. Next, the U.S. must help establish international security standards that include cyber and physical safeguards to ensure the security and integrity of space systems. Those standards must be applied across the multiple security layers to include mechanisms at the following points: the launch sites and systems; satellites; satellite ground infrastructure; access control including satellite links; and any space domain awareness systems. The combination of security layers serves as a force multiplier, thus improving security through the architecture. At least within the U.S., the government should establish enforcement mechanisms. Enforcement of the standards will help strengthen layered security capabilities, facilitate cooperation

[7] United Nations Institute for Disarmament Research, p.6.

and coordination, and boost trust and confidence in spacefaring security.

Finally, the U.S. must help establish standards for collection and distribution of space situational awareness (SSA) data. This is essential to enable expansion of existing SSA architectures. SSA data collection should include sharing satellite safety and situational data. This includes satellite status, state of health information, and positioning data. The goal of sharing this information is to increase global SSA and reduce risks of collisions. The commercial industry started this data sharing effort and the European Space Agency is building an SSA network. Given these efforts, now is the time to standardize the architectures to globalize and interconnect the multiple SSA data sources.

Globalize America's SSA Architecture

In the past, the U.S. explored the concept of expanding its SSA network to include data from multiple non-DoD sources, however those efforts did not lead to significant changes in the U.S. SSA network architecture. For example, in late 2011, leadership from the Space Data Association (SDA), the commercial data sharing cooperative, meet with DoD officials to explore the "feasibility of providing, on an experimental basis, a service able to securely combine and process operator-provided satellite location data with high-fidelity government data."[8] However, the DoD still does not automatically incorporate SDA data into the space catalog, which results in inaccurate conjunction warnings and draws concerns over the accuracy of the U.S. system.[9]

Expanding data sharing globally will help address those concerns by increasing

[8] Warren Ferster, "JSpOC Conjuntion Alerts Could Be Improved, Group Says," Space News (online), 9 Mar 12. http://www.spacenews.com/article/jspoc-conjunction-alerts-could-be-improved-group-says (accessed 20 Feb 14).

[9] Ibid. A 2011 Intelsat study found that the majority of conjunction summary messages it received from the DoD were false alarms and Intelsat independently identified a number of potential close approaches that were not reported as part of the DoD system. The article stated the expected cause of the inaccuracy is because the DoD "data are not updated often enough to accurately predict conjunctions."

accuracy of data in the space catalog. It will also minimize the workload on the existing SSA network. However, this requires changing how the U.S. views external data sources and requires major upgrades to the Space Surveillance Network (SSN) and its associated command and control system. The SSN is the DoD's primary source of gathering SSA data worldwide. It is the most exhaustive system in the world, however it has limitations.[10] The number and age of sensors affect the accuracy of the U.S. space catalog, yet the U.S. does not incorporate data from the vast number of non-U.S. sensors.[11] Inclusion of non-U.S. sensor data requires the DoD to address security concerns, data sharing standards, and technical limitations, which costs money. The U.S. must make those investments to improve its system and lead the efforts to establish global SSA. Therefore, the U.S. must look for ways to mitigate the costs.

Adding sensors to the existing SSA architecture could greatly improve global SSA coverage and accuracy while simultaneously reducing reliance on aging SSN sensors. The EU and several other non-traditional space actors are looking to assist in efforts to improve global SSA, suggesting potential interest in cost sharing. If the DoD reduced the requirements for its ground sensors there could be long-term cost savings. Additionally, if the U.S. takes on the role of global SSA data integrator, it could start charging for processing and distribution of the data.[12] Those funds could generate enough of a cost benefit to justify the program. Long-term, the cost savings may allow the U.S. to reinvest in niche capabilities, including Space Based SSA systems and creation of a global space traffic management (STM) function.

[10] SSS 2012 Educational Series, "Space Situational Awareness." Spacegeneration.org: United Nations Space General Advisory Council (online), p. 7. http://spacegeneration.org/images/stories/documents/ space_ situational_ awareness.pdf (accessed Nov 15, 2013).

[11] ibid, p. 24.

[12] ibid. p. 19. The U.S. currently shares space catalog information at no charge. This is because the U.S. believes data sharing is essential and in the best interest of the United States. However, some believe this is a cost the U.S. should not be solely responsible for undertaking.

Lead the Way For a Space Traffic Management System

The establishment of a global STM capability is long overdue. However, it first requires a robust global SSA architecture. Once global SSA is available, the U.S. should lead efforts to establish a STM capability. Today, there is no consolidated plan that synchronizes the commercial, civil, DoD and National space security efforts. In 2008, the DoD and National Reconnaissance Office (NRO) established the Space Protection Program (SPP) to help synchronize space sector security efforts. However, the program has no authority to direct action beyond the core organizations. In 2008, Scott Large, Director of the NRO, stressed the need for security efforts to encompass all space sectors. He emphasized that the "level of interconnectivity and interdependency has increased to the point where actions in one sector can conceivably affect all aspects of America's space enterprise."[13] Large's article points out the many areas where the NRO and the DoD collaborate. However, the bulk of the collaboration on security does not extend to the commercial sector.

Establishment of a U.S. STM function will enable collaboration with the commercial sector. Although much of the functionality exists within various organizations, no formal organization governs all aspects of space traffic.[14] Any effort to manage space traffic must include oversight and authority over commercial spacefaring, similar to that of the air domain's Federal Aviation Administration (FAA). The current contested, congested, and competitive space environment requires a more robust traffic management function. As the lead spacefaring nation and the nation with the most robust SSA capability, it is in the United States' best interest to lead the way with a goal of

[13] Scott F. Large, "National Security Space Collaboration as a National Defense Imperative." *High Frontier*, Vol 4, No. 4 (Aug 2008), p. 3.

[14] Stephen Hunter, Nathan Howard, and Pete Gilbert. "Implementation of Space Traffic Management Capability." Research Thesis, Joint Combined Warfighting School, 2012, p. 6.

eventually expanding functionality internationally.

Expand U.S. Threat Assessment Capabilities

Part of improving the SSA architecture and establishing a STM capability must also include improving threat detection and identification. The congested and contested nature of the space domain increases both unintentional and intentional threats. The multitude of threats and the potentially catastrophic effect of those threats require the U.S. to maintain a comprehensive threat assessment capability.

The U.S. intelligence community and space weather agencies are well postured to evaluate threats in the space domain. However, most satellite operators have little to no capability to evaluate threats, and there is no single organization responsible for managing space traffic and evaluating threats. In the past, the nations' plan for mitigating threats consisted of ad hoc efforts and limited inter-agency collaboration.[15] There were few TTPs available for operators to identify and mitigate threats. Furthermore, trouble shooting and reporting failures rarely assessed the potential of external threats as the source of the problem. If operators evaluated possible threats, they typically only did so after eliminating all system fault possibilities. The problem with this sequence of events is that threats require quick identification to properly attribute the threat and respond in a timely manner.

In March 2008, the DoD and NRO created the Space Protection Program to address these shortfalls. The program provides "decision-makers with strategic recommendations on how best to protect [America's] space systems and stay ahead of the threat."[16] The U.S. must expand the scope of this program until a STM capability is available. The program must formalize processes to provide threat data and mitigation

[15] Scott F. Large, p. 2.
[16] Ibid, p. 4.

procedures to all U.S. and Allied space users including commercial operators. Threat data must be available at the lowest possible classification level. Furthermore, the U.S. must train and exercise the mitigation procedures regularly.

Operators are the best and quickest source for identifying threats. Therefore, the Spacefaring Operational Threat Response Plan and the Spacefaring Commerce Security Plan must address how operators assess, mitigate, and report threats. By improving threat identification and reporting, the U.S. can then properly respond to threats.

Recommendation 4: Build a Layered Protection Capacity

In addition to outlining the security requirements, the Spacefaring Operational Threat Response Plan must also establish the framework for protection activities. The plan must include a DoD classified annex that outlines the required capabilities and standardization requirements for each protection layer. The plan must heavily lean on spacefaring security and global engagement efforts to minimize the protection layer. Protection efforts should rely on existing joint and national capabilities to the maximum extent possible. However, where the DoD identifies protection gaps the plan must outline risk mitigation measures. Then the DoD must develop capabilities to fill those protection gaps. Protection capabilities must balance costs, threats, and need; non-material solutions should be used to the maximum extent possible.

Non-material solutions should include development of new TTPs. The U.S. possesses many of the required protection capabilities today; however, America cannot effectively execute those capabilities because of a lack of processes and procedures.[17] Therefore, the DoD, in coordination with the intelligence community, must continue to focus on developing new protection TTPs. Additionally, the U.S. must not force

[17] Ibid. p. 4.

solutions into military capabilities. Although the DoD is responsible for protection, such activities must include capabilities derived from all elements of national power. Thus, the DoD must work as part of an interagency team to address protection activities and response mechanisms.

The U.S. response to the Chinese ASAT is a good example of a failed protection response. Although the U.S. had the best SSA network in the world, the U.S. still was ill prepared to respond to the ASAT. The 2007 Chinese ASAT created over 3,000 new pieces of trackable space debris.[18] The aftermath of the incident was anything but smooth and the international response was nearly irrelevant. This failure sent a message that irresponsible behavior in space results in few consequences.

After that event, Congressman Duncan Hunter of California, House Armed Services Committee ranking member, and Congressman Terry Everett of Alabama signed a letter to the President "calling for a change in America's defense space strategy in the face of a singular but landmark event."[19] The letter read, in part "The dependency of American warfighting capability, and the economy, on space assets compels our nation to take the necessary steps to ensure our forces cannot be targeted through an adversarial space strike."[20] The change in strategy must include establishing processes and procedures to link credible capabilities with policy. The DoD and the NRO established the SPP as a first step. However, the scope of the SPP is not adequate to address all the shortfalls in the current protection architecture.[21] Therefore, the U.S. must expand the

[18] U.S. Department of Defense. *National Security Space Strategy, Unclassified Summary*., p. 2

[19] Terry Everett, "Arguing for a Comprehensive Space Protection Strategy." *Strategic Studies Quarterly* Vol 1, No. 1, (Fall 2007) p. 21.

[20] Ibid, p. 21.

[21] Scott F. Large, p. 4. According to Large's article, the SPPs charter is to "use IC threat assessments of U.S. space adversaries to conduct engineering analysis and develop tactics, techniques, and procedures that mitigate dangers, and formalize procedures and processes that avoid duplicative efforts."

scope of the SPP and establish an authoritative organization capable of directing protection activities across the breadth of U.S. instruments of national power.

The U.S. must also be transparent about development of more robust protection capabilities. It must do so for two reasons. First, deterrence is only effective if the adversary believes a credible capability exists.[22] Therefore, the DoD must resist over-classification to ensure its programs are effective deterrents. The goal must be to communicate that credible capabilities exist without exposing capability details. Doctrine and exercises can both communicate intent and protect sensitive data.

Second, transparency is required to mitigate the security dilemma. The U.S. must carefully shape its protection efforts to mitigate mistrust, influence cooperative behavior, and build international support. Transparency enables cooperation whereas secrecy fosters resistance. Failure to minimize mistrust could result in greater threats due to the lack of transparency of U.S. efforts.

Recommendation 5: Invest in International Partnerships

The U.S. must also accept that spacefaring security cannot be a unilateral effort. Nor can the U.S. continue to thinly spread investment resources. Budget constraints coupled with the need for new security and protection initiatives requires that the U.S. extend cooperation and integration efforts with Allies and commercial partners. The U.S. must make critical decisions related to where to invest limited funds and where to rely on international partners to provide the needed space capabilities. Success of any future space initiatives requires such collaboration.

That charter is too narrowly scoped to direct the breadth of protection activities require as part of the spacefaring protection layer outlined in this paper.

[22] Gregory D. Miller, *The Shadow of the Past,* p. 10. and Gregory Miller, "International Relations Theory." Lesson slides.

A 2013 Special Report focused on security investment areas for space recommended establishing a series of bilateral and multilateral relationships with close allies to complement, supplement, and enhance U.S. capabilities. According to the report, seven allies currently possess high-resolution imaging satellites and nine possess secure military communications satellites. Additionally, a number of U.S. allies' systems are quickly catching up to the U.S. in sophistication and maturity.[23] In a fiscally constrained environment, the U.S. must utilize these capabilities to focus resources on functions that only the U.S. can perform.

[23] Jeff Kueter and John B. Sheldon. *An Investment Strategy for National Security Space*. (Washington D.C.: Douglas and Sarah Alison Center for Foreign Policy Studies, 2013). p. 16.

CHAPTER 5: CONCLUSION

> *"'Deterrence' means simply this: making sure any adversary who thinks about attacking the United States, or our allies, or our vital interests, concludes that the risks to him outweigh any potential gains. Once he understands that, he won't attack. We maintain the peace through our strength; weakness only invites aggression."*[1]
>
> - President Ronald Reagan's SDI Speech (1983)

American economic viability and military strength depend on the security of its space systems. However, current U.S. space strategy fails to protect free access to, and use of, space. The increasing congested, contested, and competitive space environment requires the U.S. to change its strategic approach to secure spacefaring. The new National Strategy for Spacefaring Security provides the conceptual framework to ensure the *U.S. has the secure, unencumbered, and sustainable use of space.* The strategy will direct the U.S. to establish spacefaring security, spacefaring protection, and global engagement capabilities. It will provide a cohesive approach to allow the U.S. to focus limited resources while simultaneously addressing a wide range challenges.

The nested approach will blend U.S. government and commercial security activities and work towards establishing the necessary capabilities, international policies, and organizations to improve spacefaring security for all nations. Each layer of the strategic model will require unique but interdependent resources to achieve the objectives. The layers of the model represent the strategic ways, the resources represent the means, and any gaps between the ways and means will create risk.

Defining the model further, the spacefaring security will represent those measures

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[1]Ronald W. Reagan, Address to the Nation (transcript), *President Ronald Reagan Address to the Nation on Defense and National Security*, (March 23, 1983). http://www. atomicarchive.com/ Docs/Missile/Starwars.shtml (accessed Feb 23, 2014).

taken to assure safety through avoidance or mitigation of threats. Those threats can be either intentional or unintentional. Security is everyone's responsibility and it requires a global understanding of the domain, multiple security layers, and international cooperation and integration. Spacefaring protection represents those measures taken to prevent or respond to an attack. Protection is necessary when security measures fail. Spacefaring protection will require establishing capabilities, TTPs, and clear policy and guidance in an effort to deter aggression. Global engagement efforts will represent the commitment and action of the international community to enforce security norms and protection efforts.

The Spacefaring Security Strategy is a significant shift in the existing space security paradigm; implementing the strategy will require major changes. To facilitate those changes, it is recommended that the U.S. develop subordinate plans to clearly outline the major efforts needed to shift U.S. strategic efforts towards improved security. Additionally, the U.S. should withdraw from the OST to force a paradigm shift to the international space regime. This shift is needed to address outdated security paradigms, build global security capabilities, and foster international collaboration. Although the international regime change will likely not agree to establishing space protection capabilities, it will at least allow the U.S. to set the norm by clearly establishing a deterrence capability and associated policy.

As President Reagan once said, the U.S. must "maintain the peace through our strength." The goal of the National Strategy for Spacefaring Security is to establish a framework for building that strength and for helping create an international regime capable of dealing with the security concerns associated with today's space environment.[2]

[2] Ibid.

APPENDIX 1

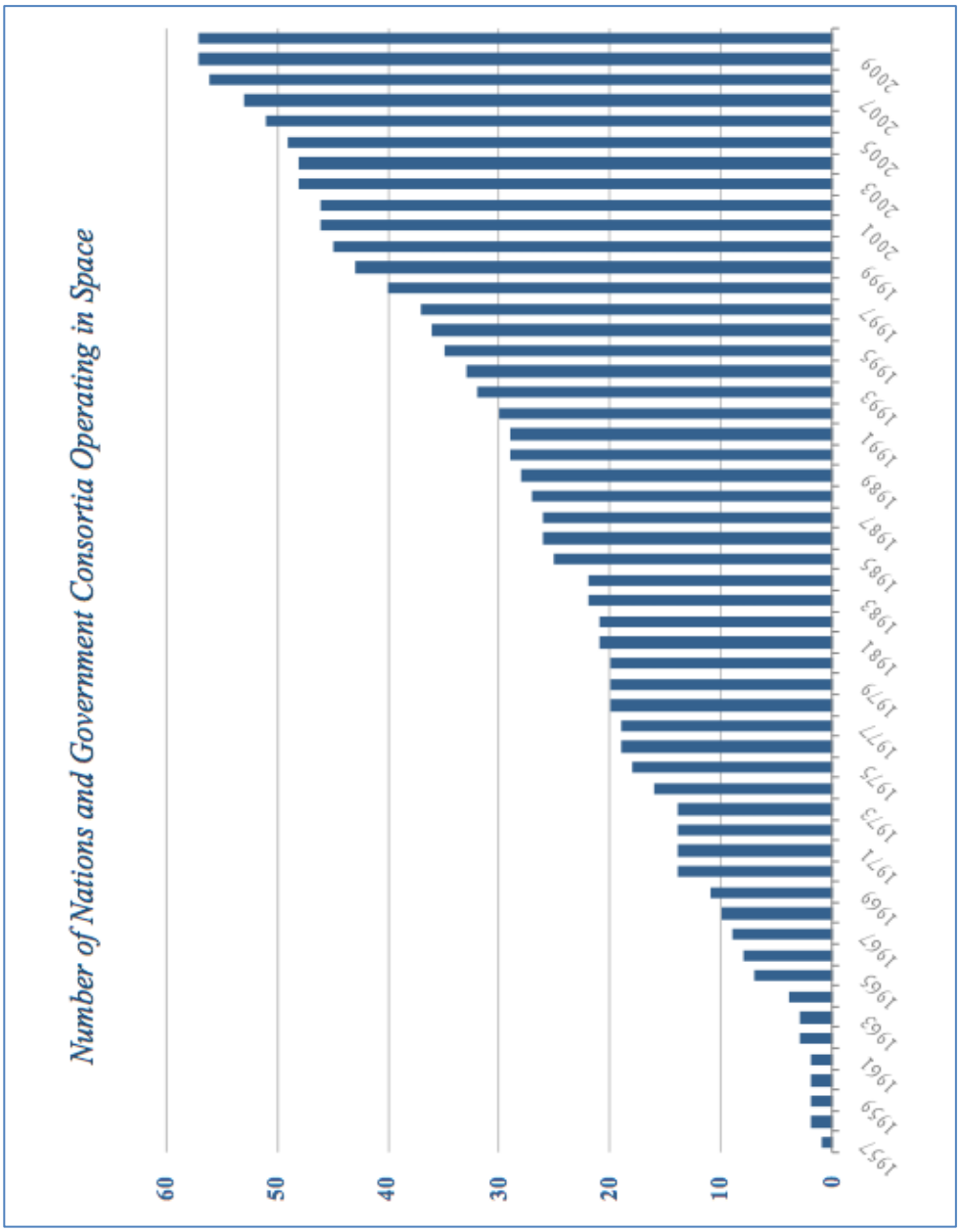

Figure A1 Growth of Objects in Space

Figure A1 illustrates the growing number of nations and government consortia operating in space as outlined in the current 2010 National Security Space Strategy.[3] Of note, over 50 different nations or government consortia are operating in space today.

[3] U.S. Department of Defense. *National Security Space Strategy, Unclassified Summary*. by Secretary of Defense Robert M. Gates and Director of National Intelligence James R. Clapper. (Washington, D.C.: Department of Defense. 2011), p. 2.

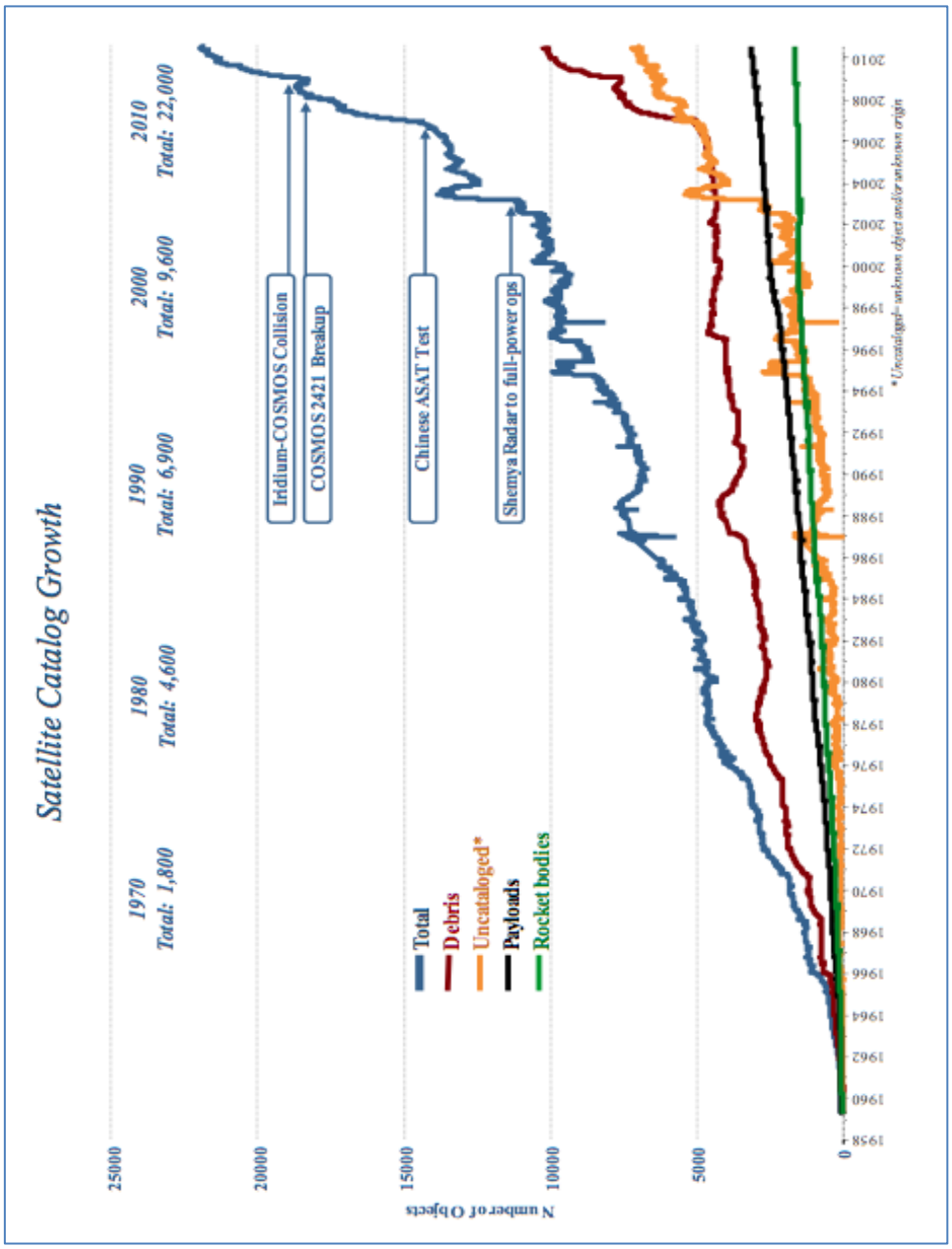

Figure A2 Growth of Nations/Consortia in Space

Figure A2 illustrates the growing number of objects tracked in space as of 2010.[4] The figure illustrates how satellite collisions substantially affect the problem of space debris (reference the Chinese ASAT and the Iridium Cosmos collision) and how quality space surveillance systems can improve domain awareness (reference the increase in trackable objects when the Shemya radar became FOC).

[4] Ibid, p. 1.

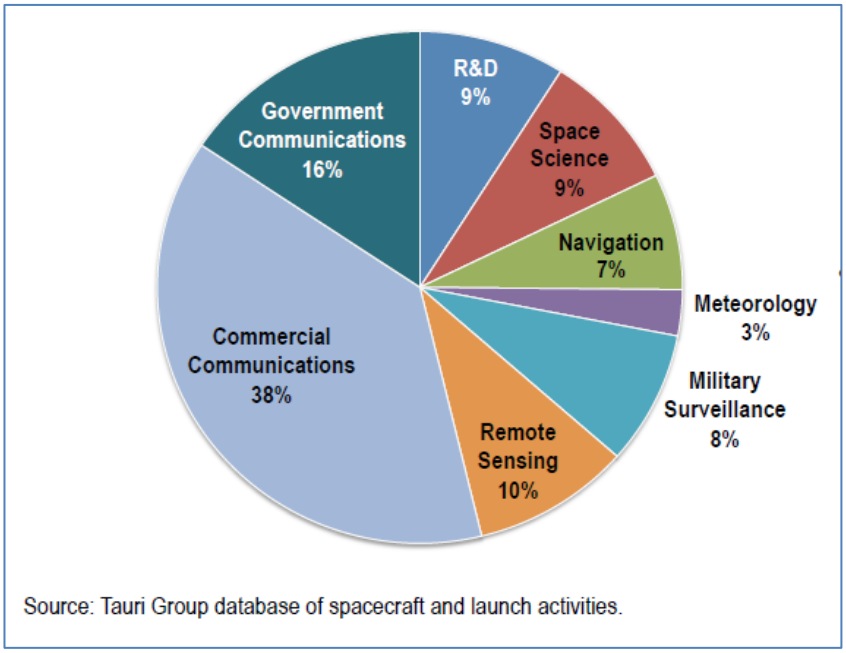

Figure A3: Satellites by Function

Figure A3 illustrates the percentage of satellites primarily dedicated to various functions based on data derived the 2012 satellite catalog. Of note, greater than 50% of the current operational satellites are communications satellites.

Figure A4: Connecting Objectives in the Nested Spacefaring Security Model

Figure A4 highlights this nested relationship between the means and highlights the connection between the means and the strategic objectives. The figure illustrates how the strategic objectives can be aligned within the major elements of the security strategy.

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BIBLIOGRAPHY

Government Documents

Bush, George W., National Strategy, *National Space Policy of the United States of America*. Washington, D.C.: Executive Office of the President, 2006.

Bush, George W., National Strategy, *National Strategy for Aviation Security.* Washington, D.C.: Executive Office of the President, 2007.

Bush, George W., National Strategy, *National Strategy for Homeland Security*. Washington, D.C, U.S. Homeland Security Council., 2007.

Bush, George W., National Strategy, *National Strategy for Maritime Security,* Washington, D.C.: Executive Office of the President, 2005

Obama, Barack H., National Strategy, *National Space Policy.* Washington, D.C.: Executive Office of the President, 2010

Reagan, Ronald W., Address to the Nation (transcript), *President Ronald Reagan Address to the Nation on Defense and National Security*, March 23, 1983. http://www. atomicarchive.com/ Docs/Missile/Starwars.shtml (accessed Feb 23, 2014)

U.S. Department of Defense. *Quadrennial Defense Review Report.* by Secretary of Defense Robert M. Gates. Washington, D.C.: Department of Defense. 2010.

U.S. Department of Defense. *National Security Space Strategy, Unclassified Summary*. by Secretary of Defense Robert M. Gates and Director of National Intelligence James R. Clapper. Washington, D.C.: Department of Defense. 2011.

U.S. Department of Homeland Security. *National Security Telecommunications Advisory Committee Issue Review: Enhancing National Security and Emergency Preparedness through Communications*" Washington, D.C.: Department of Homeland Security. 2010.

United Nations. *United Nations Treaties and Principles on Outer Space*. New York: United Nations. 2008.

United Nations Institute for Disarmament Research, *2013 Conference Report on Space Security.*, http://www.unidir.org/files/publications/pdfs/space-security-2013-en-467.pdf (accessed Nov 20, 2013)

Books

Chapman, Bert., *Space Warfare and Defense.* Santa Barbara, California: ABC Clio Publishers, 2008.

Dolman, Everett C., *Astropolotik: Classical Geopolitics in the Space Age*. New York: Frank Cass Publishers, 2002.

Miller, Gregory D., *The Shadow of the Past: Reputation and Military Alliances Before the First World War.* Ithaca N.Y.: Cornell University Press, 2012

Jasentuliyana, Nandasiri, *International Space Law and the United Nations.* Netherlands: Brill Academic Publishers, 1999.

Logsdon, John M., *Human Spaceflight: Projects Mercury, Gemini, and Apollo*. Vol. 7, Washington D.C.: Government Printing Office, 2008.

MacDonald, Bruce W., China, Space Weapons, and U.S. Security, Washington, D.C.: Council on Foreign Relations, 2008.

Moltz, James C., *The Politics of Space Security: Strategic Restraint and the Pursuit of National Interests.* Stanford, California: Stanford Security Studies, 2008.

Rumelt, Richard, *Good Strategy Bad Strategy: The Difference and Why it Matters.* New York: Crown Business Publishing, 2011.

Seabury, Paul, and Angelo Codevilla. *War: Ends and Means.* New York: Basic Books, 1989

Articles

Everett, Terry. "Arguing for a Comprehensive Space Protection Strategy." *Strategic Studies Quarterly* Vol 1, No. 1 (Fall 2007): 20-35.

Glaser, Charles L. "The Security Dilemma Revisited", *World Politics*, Vol 50, No. 1 (Oct 1997), 171-201.

Harper, Jacob M. "Technology, Politics, and the New Space Race: The Legality and Desirability of Bush's National Space Policy under the Public and Customary International Laws of Space." *Journal of International Law*. Vol. 8 Issue 2 (Winter2008): 681-689.

Jervis, Robert. "Cooperation Under the Security Dilemma," World Politics 30, no. 2, (Jan 1978): 186-214.

Large, Scott F. "National Security Space Collaboration as a National Defense Imperative." *High Frontier*, Vol 4, No. 4 (Aug 2008), 3-5.

Lykke, Arthur F., "Towards an Understanding of Military Strategy." *U.S. Army War College Guide To Strategy*, (Feb 2001), 179-186. http://www.au.af.mil/au/awc/ awcgate/ ssi/00354.pdf. (accessed Jan 17, 2014).

NASA, "Satellite Collision Leaves Significant Debris Clouds". *Orbital Debris Quarterly News*, Vol 13, Issue 2 (April 2009). http://orbitaldebris.jsc.nasa.gov/newsletter /pdfs/ODQNv13i2.pdf (assessed Jan 17, 2014)

Other Secondary Sources

Aerospace Industry Association, *The Economic Impact of Sequestration on Civil Space Programs.* http://www.aia-aerospace.org/assets/FINAL_Booklet_Copy_of_NASA_ NOAA_Space_Report_12.11.12.pdf. (accessed Feb 15, 2014).

Al Jazeera, "Egypt Jamming Al Jazeera's Satellite Signals," Al Jazeera America. http://www.aljazeera.com/video/middleeast/2013/09/201393183256834226.html (accessed Nov 13, 2013).

Covault, Craig, "UAVs Drive SATCOM Modernization." Defense Media Network. http://www.defensemedianetwork.com/stories/ uavs-drive-satcom-modernization/ (accessed Jan 15, 2014).

Eberhart, Paul B., "Grand Strategy of the United States: A Study of the Process." Master's Thesis. Joint Forces Staff College (25789), 2009. http://www.dtic.mil/dtic/tr/ fulltext/u2/a530097.pdf (accessed 24 Feb, 2014).

Fearon, James D., "The Offense-Defense Balance and War Since 1648." Paper presented at the Annual Meeting of the International Studies Association, Chicago, IL, 1995.

Ferster, Warren, "JSpOC Conjuntion Alerts Could Be Improved, Group Says," Space News (online), Mar 9, 2012. http://www.spacenews.com/article/jspoc-conjunction-alerts-could-be-improved-group-says (accessed 20 Feb 14)

Heritage Foundation Lecture. "The 10th Anniversary of the Anti-Ballistic Missile Treaty Withdrawal," Washington D.C.: Heritage Foundation Lecture No. 1220, Jun 13, 2012. http://www.heritage.org/research/lecture/2013/02/the-10th-anniversary-of-the-anti-ballistic-missile-treaty-withdrawal (accessed Feb 22, 2014).

Horrocks, Peter. "Satellite and Internet Jamming Rises as Broadcast Industry Seek to Uphold UN Article 19." BBC. http://www.bbc.co.uk/mediacentre/latestnews/ 2012/201112 wsjammingconference.html (accessed Nov 13, 2013).

Hunter, Stephen, Nathan Howard, and Pete Gilbert. "Implementation of Space Traffic Management Capability." Research Thesis, Joint Combined Warfighting School, 2012.

Kueter, Jeff and John B. Sheldon. *An Investment Strategy for National Security Space*. Washington D.C.: Douglas and Sarah Alison Center for Foreign Policy Studies, 2013. http://www.heritage.org/research/reports/2013/02/an-investment-strategy-for-national-security-space?ac=1 (accessed Apr 6, 2014).

Marshall Institute. "Space as a Vital National Interest.", Marshall Institute Policy Outlook (online), August 2005, pp. 3-4. http://marshall.org/wp-content/uploads/2013/08 /315.pdf

Marshall, Tyrone. "DoD Officials Detail $1 Billion in Space Program Savings." American Forces Press Service, Apr 26, 2013. http://www.defense. gov/news/newsarticle.aspx?id=119889 (accessed Feb 8, 2014).

Miller, Gregory. "International Relations Theory." Lesson slides presented to the Joint Advanced Warfighting School, Norfolk, VA, Joint Forces Staff College, Nov 8, 2013.

NewTec. "93% of the industry suffers from satellite interference." NewTec. http://www.newtec.eu/article/release/93-of-the-industry-suffers-from-satellite-interference (accessed Nov 13, 2013).

O'Callaghan, Jonathan, "How Many Countries Have Rockets Capable of Reaching Space?", All About Space (online). March 21, 2013. http://www.spaceanswers.com/ space-exploration/how-many-countries-have-rockets-capable-of-reaching-space/ (accessed May 28, 2014)

Perrin, Chad, "Understanding Layered Security and Defense in Depth.", TechRepublic. Dec 18, 2006. http://www.techrepublic.com/blog/it-security/understanding-layered-security-and-defense-in-depth (accessed Feb 12, 2014)

Rusek, Ben, "The Outer Space Treaty at a Glance." Arms Control Association. https://www.armscontrol.org/factsheets/outerspace (accessed Feb 17, 2014).

Satellite Industry Association Report, "State of the Satellite Industry Report." Satellite Industry Association, http://www.sia.org/wp-ontent/uploads/2013/10/2013_SSIR_ Final_Oct.pdf (accessed Nov 13, 2013).

SSS 2012 Educational Series, "Space Situational Awareness." Spacegeneration.org: Space General Advisory Council, http://spacegeneration.org/images/stories/ documents/ space_ situational_ awareness.pdf (accessed Nov 15, 2013).

Union of Concerned Scientists, 9-1-13 Satellite Database. *Communications Satellites.* http://www.ucsusa.org/ nuclear_ weapons_and_global_security/solutions/space-weapons/ucs-satellite-database.html

VITA

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